Vol. XVI, No. 5 JUNE, 1946

OFFICIAL PUBLICATION OF THE ASTE AMERICAN SOCIETY OF TOOL ENGINEERS

Departments

Somewhere in every shop, whether large or small, is a place devoted to precision measurement. Whatever its size, this measuring control is one of the most essential places in your plant.

The importance of precise measurement increases as the tolerances become closer. Industry is finding out that when the working limits have been selected and adhered to properly, the product will assemble easily and quickly, thus lowering the production cost.

The war set new standards of measurement. Peacetime competition may require even higher ones.

What are today's

CRITERIA OF MEASUREMENT?

If you are seeking the answer to this question, or if you are planning a "Standards Room" for the control of measurement in your plant, we want you to have this new booklet.

"Criteria of Measurement" is illustrated in full color. It tells you how to set up your own central measuring laboratory and describes the basic measuring equipment that will be needed in it.

Write for "Criteria of Measurement" on your firm letterhead.

Division **Niles-Bement-Pond Company**

WEST HARTFORD 1, CONNECTICUT

PUBLISHED MONTHLY BY

THE TOOL ENGINEER

AMERICAN SOCIETY OF TOOL ENGINEERS

Volume XVI **June, 1946** **Number 5**

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American Society of Tool Engineers

National Headquarters

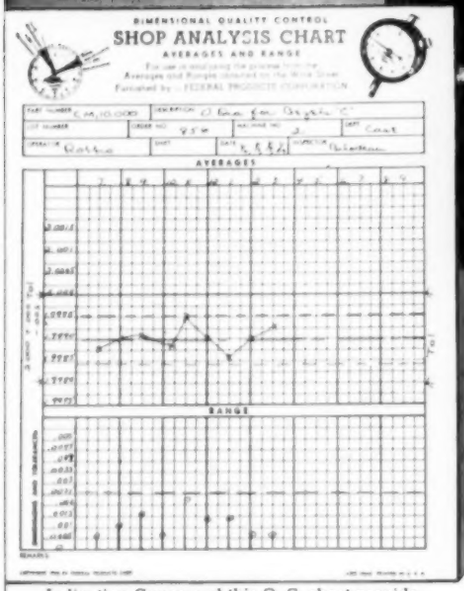
1666 Penobscot Bldg. **Detroit 26, Michigan**

The TOOL ENGINEER
Editorial and Advertising Offices:
1922 West Canfield **Detroit 8, Michigan**

The Tool Engineer is published monthly at 1666 Penobscot Building, Detroit 26, Michigan, in the interest of the members of the American Society of Tool Engineers. Advertising and Editorial departments are located at 1922 West Canfield, Detroit 8, Michigan. Subscription is $2.00 per year. Non-members $6.00 per year in the U.S.A., Canada $6.50 per year; all other foreign countries, $8.00 per year. Entered as second-class matter February 8, 1945, at the post office at Detroit, Michigan, under the Act of March, 1879.

DIMENSIONAL QUALITY CONTROL

Dimensional quality is controlled directly at the machine.



Indicating Gages and this Q. C. chart provide the data and means to keep dimensions under control.

3 GAGING SYSTEMS

MECHANICAL

Adaptable and economical Dial Indicating Gages for the usual control requirements.

AIR

A new air System for extremely fine finishes and measurements. Many new exclusive features.

ELECTRONIC

An extremely fast, sensitive instrument with a multitude of possibilities.

Economical Control at Production — a Management Tool

Federal Indicating Gages plus Quality Control Charts Make Graphic what is happening at the Machine

The case history of the application illustrated above of Quality Control by statistical methods, based on the accurate readings of the Federal Indicating Gage, shows the practical result of controlling a critical dimension of our own product.

A piece intrinsically difficult to turn, a dimension hard to maintain, and an out-of-round condition prohibited by assembly conditions. Rejects, rework and scrap ran high, unit hours low. Imperfections at this operation directly fostered inaccurate performance of the finished instrument.

After the introduction of Quality Control scrap figures dwindled by 75%. Even greater satisfaction was gained from the even flow of homogeneously dimensioned pieces coming from this operation.

With Quality Control and Federal Indicating Gages inaccuracies are discovered *before* they develop, operator interest increases, wasted time and material disappear and a product is made that renders better service to the ultimate user.

Write for the Federal Quality Control Primer, a simplified, practical way to apply Quality Control.

FEDERAL PRODUCTS CORPORATION

1144 EDDY STREET PROVIDENCE 1, R. I.

The Federal Quality Control Primer will be mailed to anyone interested in this new management tool.

*Quality Control by Statistical Methods.

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STANDARD

DuBo* Gage

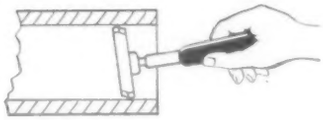
SINGLE END
Sizes 1.510" to 6.010" (38 to 152 mm)

DOUBLE END
Sizes .240" to 1.510" (6 to 38 mm)

LIGHT IN WEIGHT

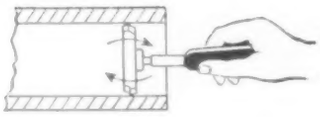
DuBo Gages over 1" diameter weigh 70% to 80% less than corresponding AGD cylindrical plug gages. Their lightness gives greater ease in handling, resulting in less strain on the operator, fewer errors due to fatigue.

EASY TO ENTER



DuBo requires no jockeying to enter, even into undersize bores. Inserted with the handle tipped slightly above the bore axis, it enters easily, more easily than even a piloted cylindrical plug gage. This means time saved.

DEFINITE CHECK



The check is made by lowering the handle gently, bringing gaging surfaces in contact with bore walls. Whether or not handle will drop freely below bore axis is the definite, yes-or-no answer even if part is close to limit.

DuBo Gages can detect out-of-roundness and taper whether enlarging toward or away from the opening!

ARMY E NAVY

*Patents Pending

IT ALL ADDS UP TO PRODUCT IMPROVEMENT *along with* COST SAVING

Write for Bulletin

STANDARD GAGE CO., Inc., Poughkeepsie, N.Y.

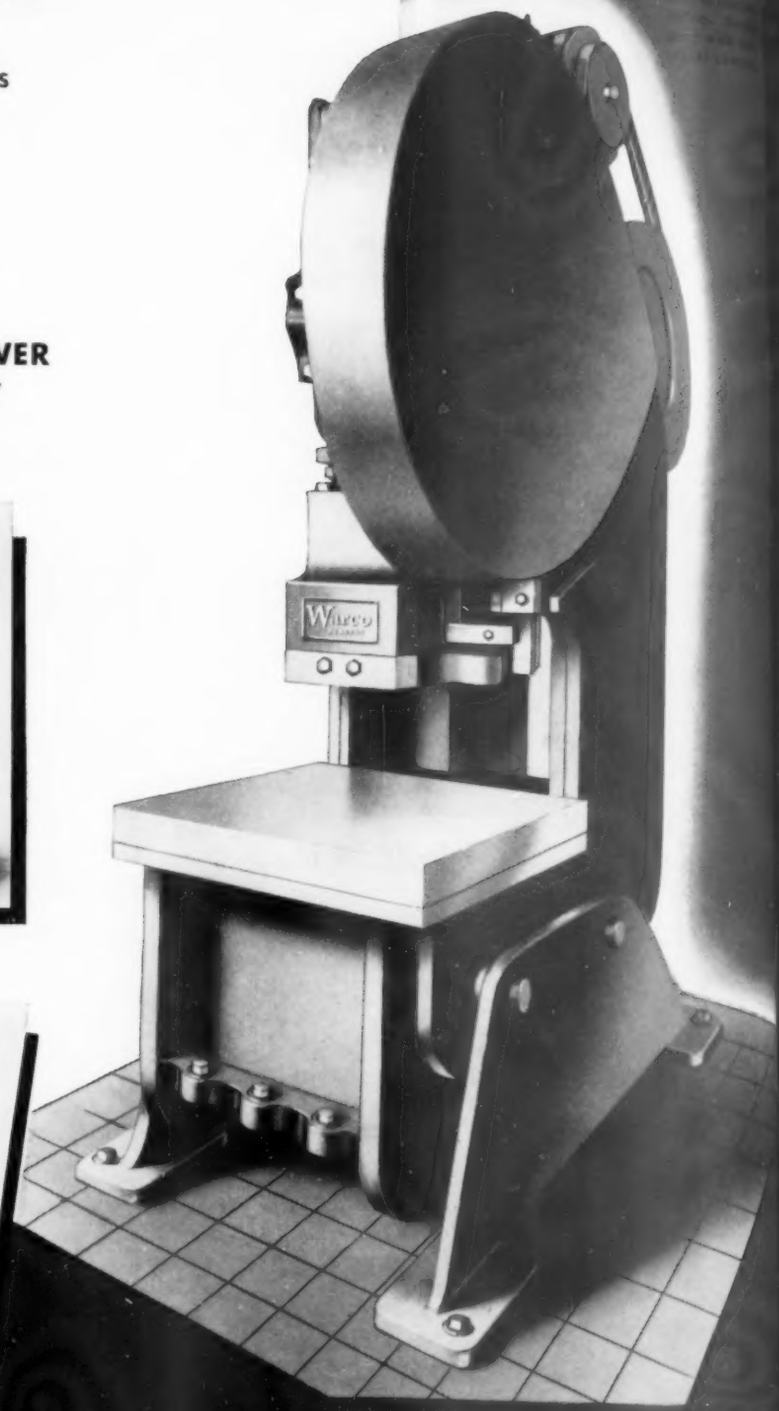
A Complete Line of

ALL-STEEL WELDED

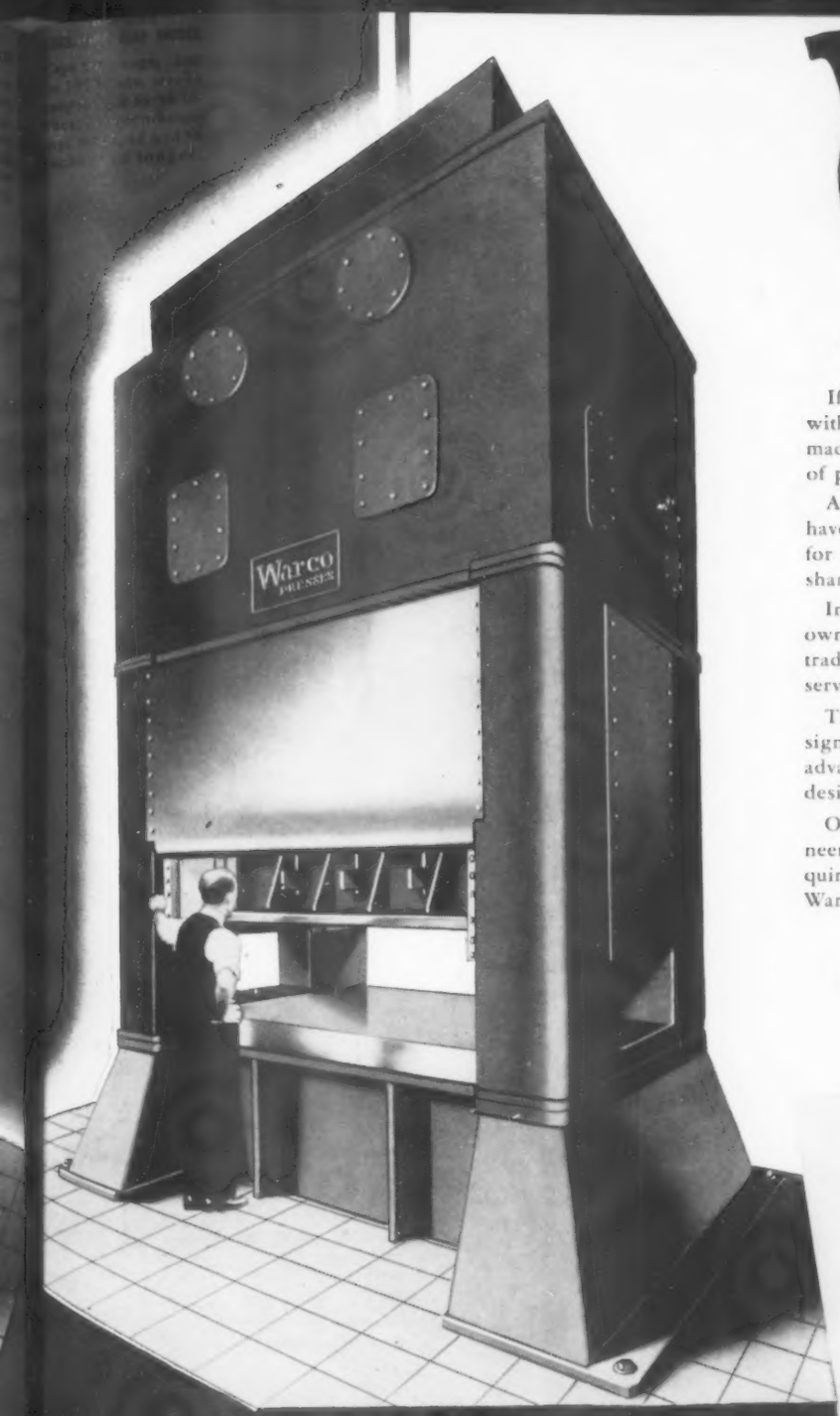
★ Open Back Inclinable Models
★ Two-Point Eccentric-Gear Models
★ *Straight-Sided Hydraulic Models*
★ Mechanical Press Brakes

All weldments are *fully stress-relieved* to provide maximum

★ **RIGIDITY** ★ **STRENGTH** ★ **POWER**
★ **ENDURANCE** ★ **ACCURACY**



Above, press brake, capacity range, 100 to 500 tons, to handle lengths up to 24 feet and longer. Right, double-crank gap press, capacity range, 100 to 500 tons.



Warco PRESSES

If you have been fortunate enough to receive a press within the last nine months, chances are that it was made entirely or in part by Warco's experienced staff of press engineers and craftsmen.

A portion of our tremendous engineering and production facilities have been and are now being utilized building presses and press parts for a group of companies which have in the past handled the largest share of the nation's press business.

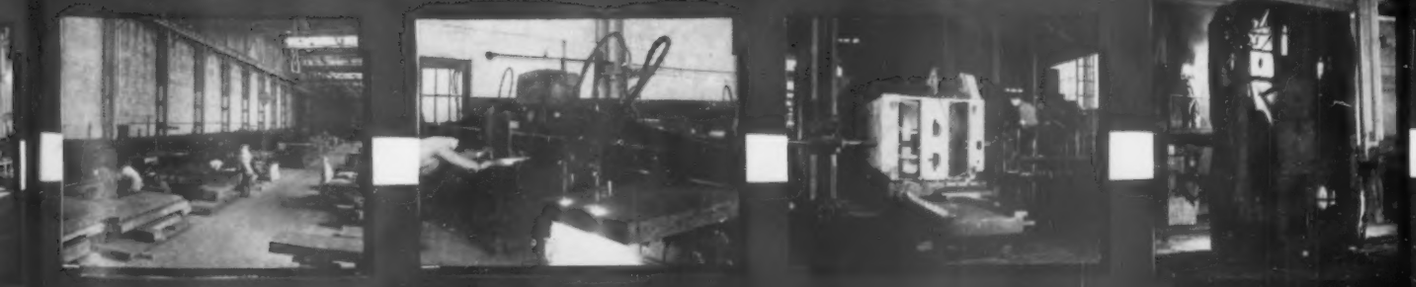
In introducing the new line of all-steel welded presses under our own trade name, "Warco", we are making available directly to the trade the know-how, experience and facilities that have enabled us to serve other press builders so eminently.

The "Warco" line represents the finest in press construction—designed by one of the country's leading press engineers—embodying advantages based on what press users themselves have told us they desire most in such equipment.

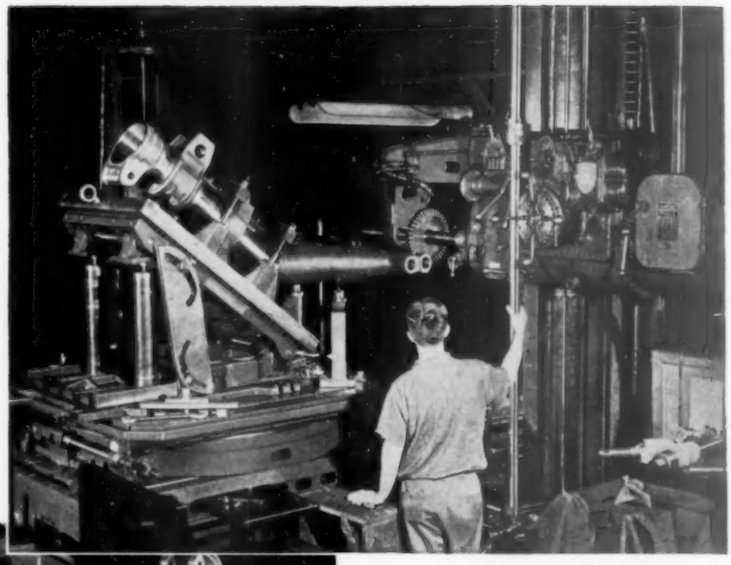
Our organization is prepared to render a complete service for engineering and building a wide range of models to meet your specific requirements. We invite you to avail yourself of the many benefits which Warco offers its customers. For full details, get in touch with us today.

WARREN CITY MANUFACTURING COMPANY
1946 GRISWOLD STREET • WARREN, OHIO
a subsidiary of
THE FEDERAL MACHINE AND WELDER COMPANY
Offices in Principal Cities

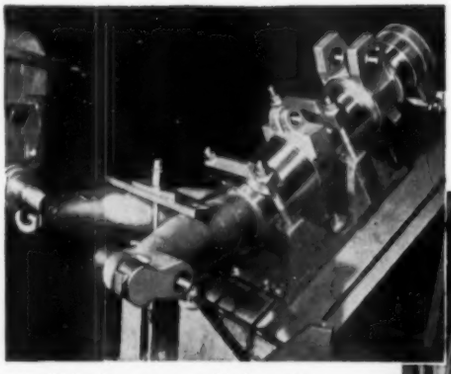
Left, straight-sidec hydraulic press, ca pacity range 10(tons to 1200 tons stroke range 10 tc 30 inches. Between housings range, 3(to 156 inches anc longer.



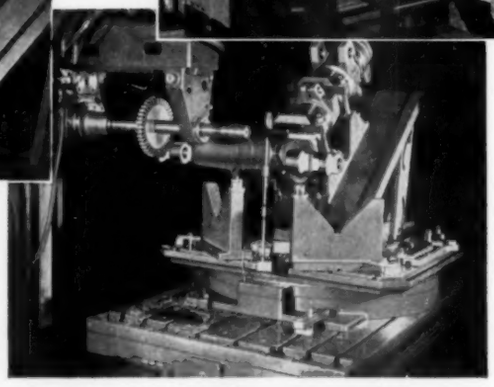
THERE'S ALWAYS A *Common Sense* WAY TO EFFICIENTLY HANDLE WORK LIKE THIS *on a* G. & L.



A combination of standard attachments is used on this Giddings & Lewis table type machine to simplify the setup and machining of an Aerol landing gear cylinder.

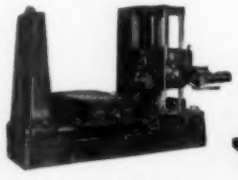


Aerol landing gear cylinder. Its awkward shape requires ingenuity in setting-up for precision machining operations.

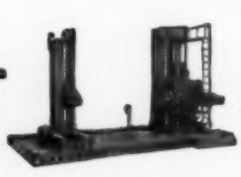


Conventional side milling operation being performed on a G. & L. horizontal boring machine equipped with an overarm type arbor support.

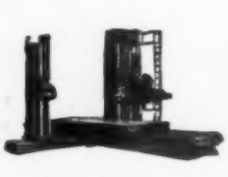
Photographs through the courtesy of the Cleveland Pneumatic Tool Company, Cleveland, Ohio



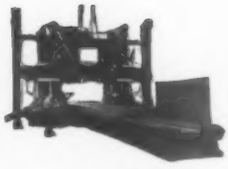
G. & L. Table Type Machine



G. & L. Floor Type Machine



G. & L. Planer Type Machine



G. & L. Multiple Head Type Machine

GIDDINGS & LEWIS MACHINE TOOL CO.

IT IS *Common Sense* TO:

1. Use a simple holding fixture on unusual shaped parts.
2. Mill, drill and bore in a single work setting.
3. Index work on a rotary table for correct alignment.
4. Use standard machines with helpful attachments for difficult operations.
5. Use a Giddings & Lewis machine on irregular parts similar to this aircraft landing gear cylinder.

There is always a practical and common sense way to set up odd-shaped work and perform difficult machining operations on a Giddings & Lewis machine. These graphic illustrations show how an awkward-to-handle aircraft landing gear cylinder is setup and machined on a standard G. & L. equipped with standard attachments. Few other machines have the open working range, capacity and flexibility required to mount this work and then perform precision boring, drilling and milling operations. Trunnions, trunnion lugs, drag brace lugs and lock lugs are machined before the part is removed from its holding fixture.

Attachments Reduce Machining Time and Eliminate Excessive Handling

Three standard G. & L. attachments are used to cut machining time and reduce set-ups on this part. They are:

(1) Combination plain and hand feed rotary table that indexes the work with micrometer accuracy and on which the holding fixture is mounted.

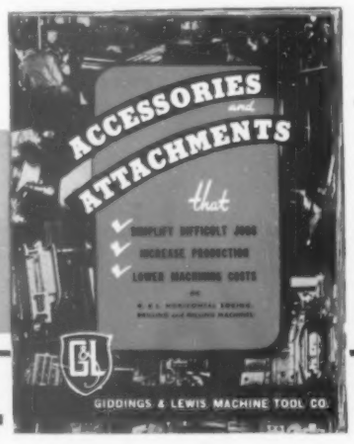
(2) An overarm arbor support attachment is used to permit milling the slots in the trunnion lugs. The part does not have to be routed to a conventional milling machine when this attachment is used.

(3) An angular milling attachment (not shown) mills the flats on the trunnion lugs and drills and bores at right angles to the machine spindle. The work remains in its fixture for these operations. This combination of helpful attachments increases the working range and adds to the flexibility of the Giddings & Lewis horizontal boring machine.

When you are confronted with the problem of machining work of unusual size or shape, it is advantageous to consider standard G. & L. equipment for your needs. Experienced Giddings & Lewis engineers will gladly point out ways and means of reducing costs on special as well as general run work.

NEW 48-PAGE BOOK *Free*

Descriptive of G. & L. accessories and attachments written especially for men interested in increasing production. Write now for your copy — ask for Catalog T. E. 66.



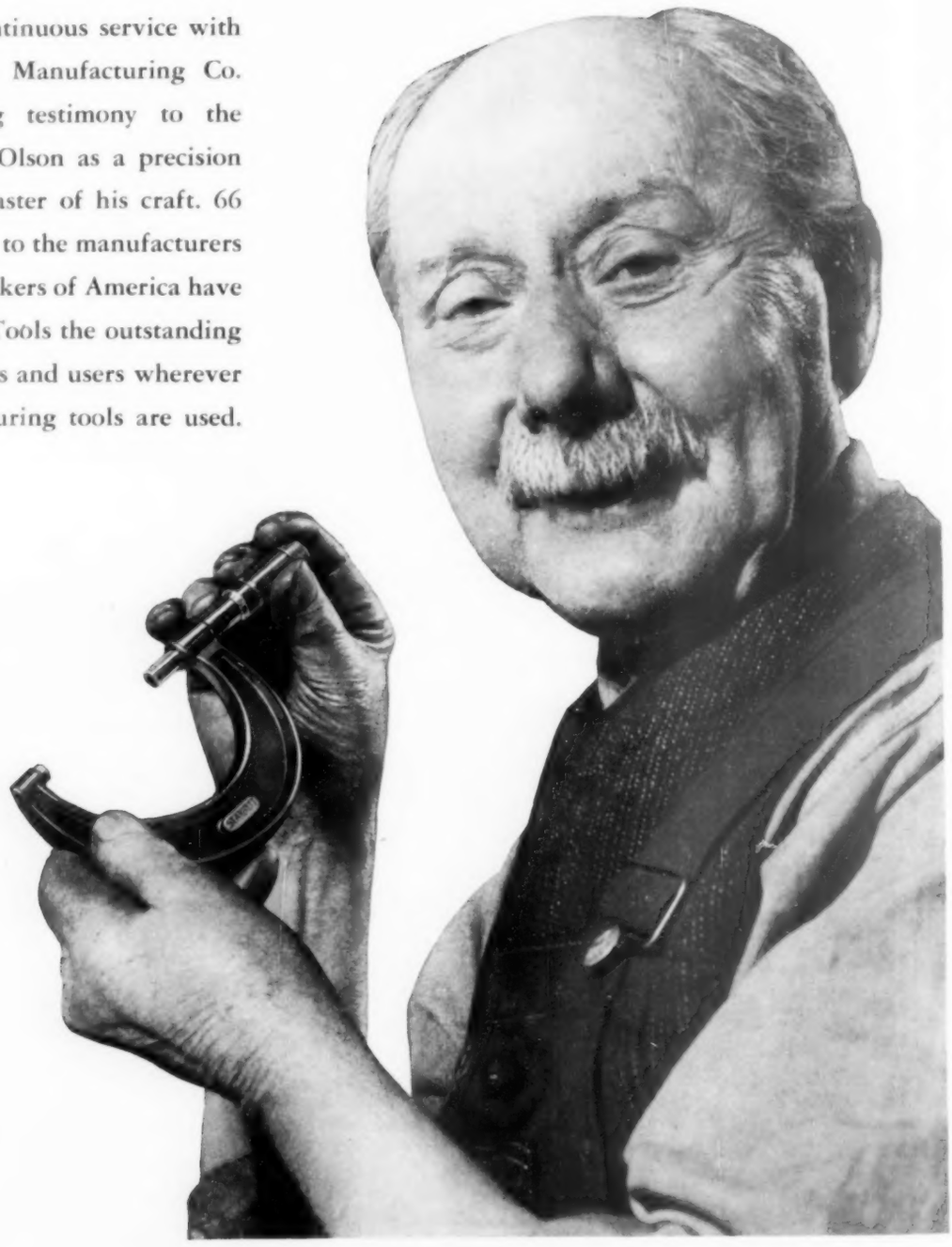
132 Doty Street • Fond du Lac, Wis.

STARRETT TOOLS

A TIME-HONORED VETERAN OF THE PRECISION WORKER'S CRAFT

Photo courtesy Allis-Chalmers Mfg. Co.

41 years of continuous service with Allis-Chalmers Manufacturing Co. are convincing testimony to the value of Olaf Olson as a precision worker and master of his craft. 66 years of service to the manufacturers and skilled workers of America have made Starrett Tools the outstanding choice of buyers and users wherever precision measuring tools are used.



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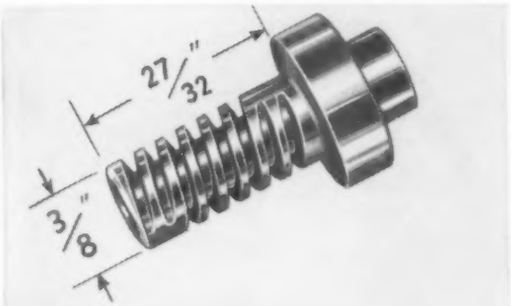
SHEFFIELD MACHINE TOOL DATA

TFG #121

CRUSH GRINDING MULTIPLE START WORMS
ON SHEFFIELD PRECISION THREAD AND FORM GRINDER



BRONZE WORM FOR SPEED REDUCTION
32 D.P. — 14½° P.A. — 2 THD. L.H.
PLUNGE GRIND IN 35 SECONDS

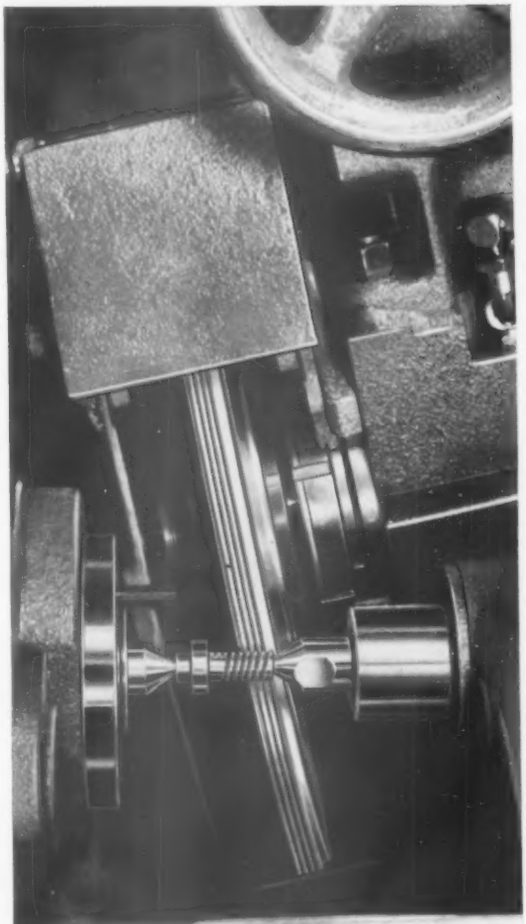
Multiple or single start worms can be quickly and economically produced by Crush Grinding with a Multi-Rib wheel.

Evidence substantiating this statement is incorporated in the following case history.

The part illustrated is a double start 32 diametral pitch worm with conventional 14½° pressure angle. Material is bronze. P.D. tolerance is to be held to .003 over wires. As practically all worms have clearance between the root and the mating worm wheel, a radius at the root presents no problem in assembly.

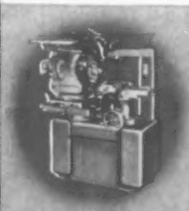
The multi-rib wheel, crush trued, was set at the required helix angle, 11° 26'. The wheel was briskly plunged to depth inside the outer center of the part so as not to cut through the thrust face. The cut was stopped close to the shoulder of the gear diameter to prevent the wheel marking the shoulder.

The grinding time of 35 seconds produced both starts simultaneously. Burrs usually produced in conventional thread milling are eliminated by crush grinding.



MACHINE SETUP TO GRIND DOUBLE START LEFT HAND WORM WITH CRUSH TRUED MULTIRIB WHEEL. HELIX ANGLE 11° 26'

In the majority of cases, crush plunge grinding of threads or forms will reduce substantially your present manufacturing costs. Write for Bulletins M-100-145 and M-120-144.



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It's the Gisholt Hydraulic Speed Selector.

Through this one dial type control, the turret lathe operator can instantly shift to any one of 12 spindle speeds without stopping the spindle or releasing the main drive clutch. This means that no time is wasted in shifting gears—no calculations from cutting speed to spindle speed are necessary. When the job is set up and ideal machining speeds determined, with reference to the diameter of the work, the operator can pre-set the Speed Selector for each step in the machining process, merely touching a trip to effect each successive change.

Instant in response and power-operated, the Gisholt Hydraulic Speed Selector not only saves time between cuts but also increases production by making it simple for the operator to use the most efficient speed for each cut. It is available on all sizes of Gisholt Saddle Type and Ram Type Turret Lathes.

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Check These New *Super* Features For Lower Production Costs!

NEW *SUPER* EJECTOR-TYPE TOOL BIT

SUPER EJECTOR TYPE TOOLS
(Complete with 1 Carbide bit)

TOOL ORDER NUMBER		SHANK SIZE	SIZE SOLID CARBIDE INSERT
RIGHT HAND	LEFT HAND		
ER-1	EL-1	3/4x3/4x4 1/2	1/4x1/4x2
ER-2	EL-2	1x1x7	3/8x3/8x2
ER-3	EL-3	1 1/4x1 1/4x8	3/8x3/8x2
ER-4	EL-4	1 1/2x1 1/2x8	3/8x3/8x2
ER-5	EL-5	3/4x1x6	3/8x3/8x2
ER-6	EL-6	1x1 1/4x8	3/8x3/8x2
ER-7	EL-7	1x1 1/2x8	3/8x3/8x2

SOLID CARBIDE BITS for SUPER EJECTOR TYPE TOOLS

TOOL ORDER NUMBER		SIZE
FOR STEEL	FOR IRON, NON-FERROUS MAT., PLASTICS	
ES-1	EG-1	1/4x1/4x2
ES-2	EG-2	3/8x3/8x2

NOTE: Above bits are ground to fit holder, and require only sharpening at cutting end.

1. Bit-Holding Mechanism is inside where it can't interfere with free chip flow or assembly in tool block.
2. The heavy cross section of well supported Carbide insures the successful making of deep cuts and heavy feeds without cracking.
3. Absence of brazing strains due to mechanical holding of tip.
4. Tool life is doubled due to compound angles used. When the Carbide bit is ejected, it rises in the holder, permitting a light regrinding cut on top, end, and side, producing a new, sharp cutting edge with the absolute minimum loss of Carbide.
5. No steel is removed in grinding, insuring rapid and economical reconditioning of the tool.
6. Replaceable Carbide bit is extra long for longer life.
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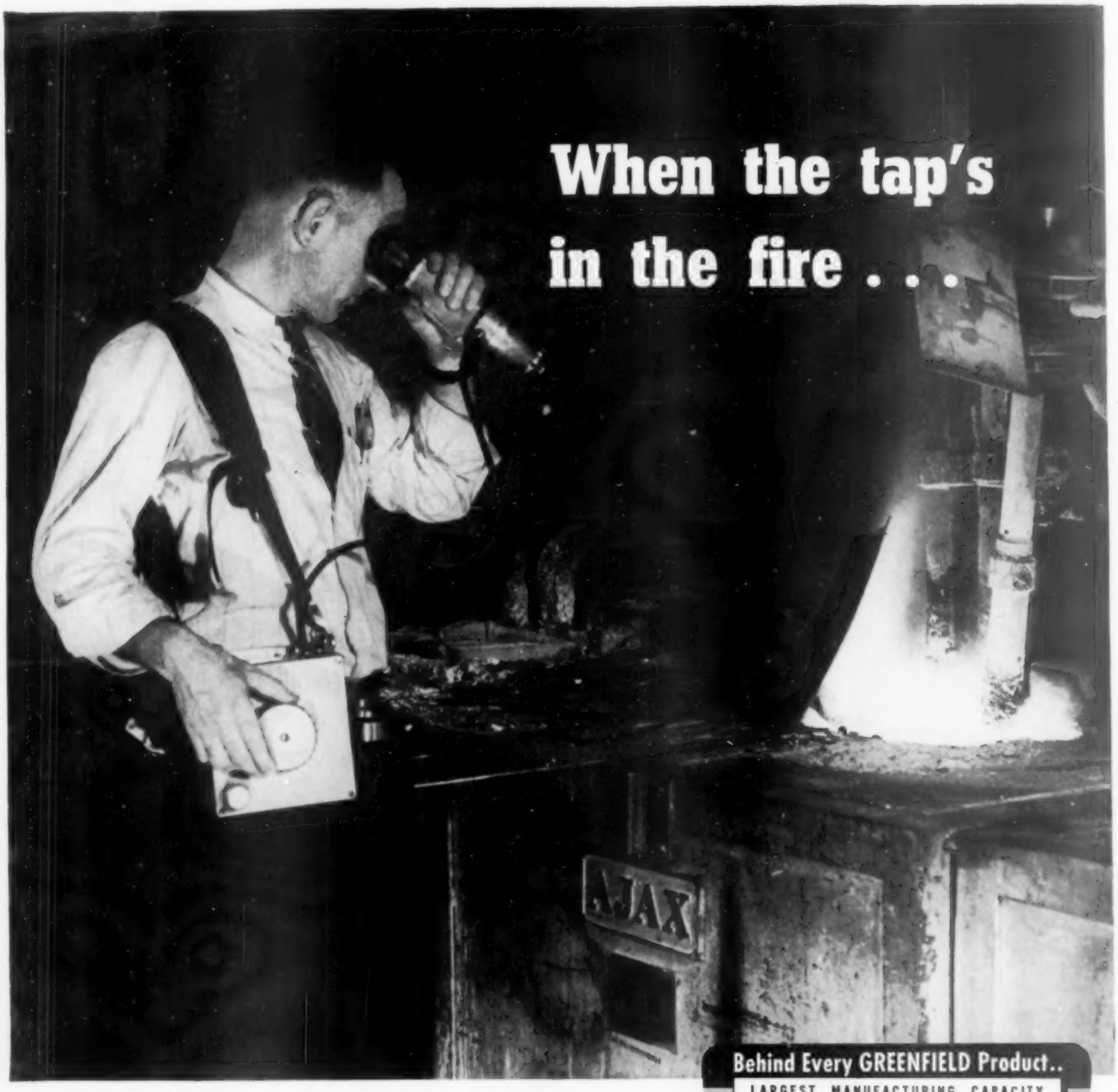

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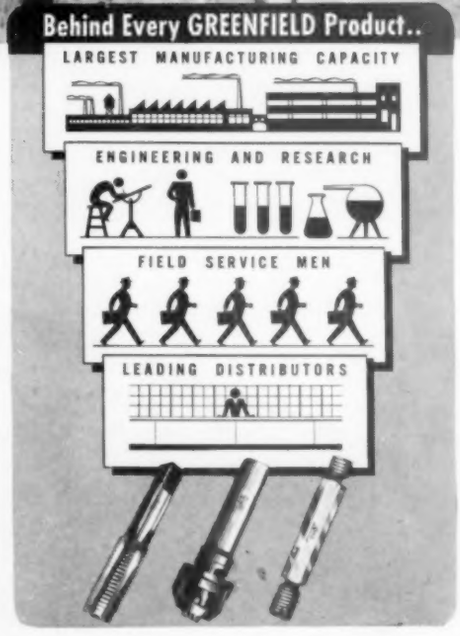
It is a science that contributes much toward your getting ***more for your money*** when you use "Greenfield" tools and "Greenfield's" "Show-How" field service.



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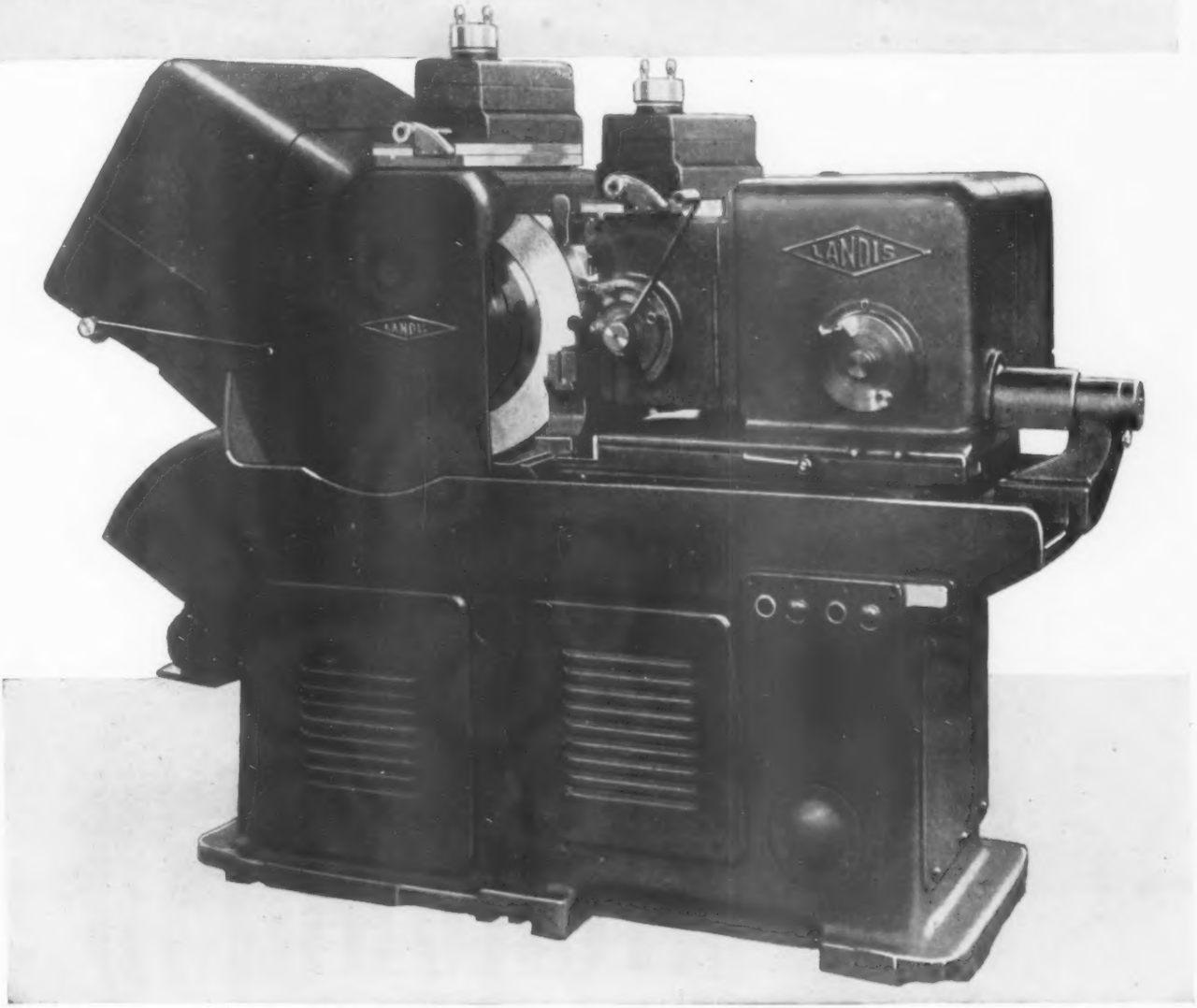

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Editorial

Value of Membership

THE AVERAGE businessman and engineer belongs to anywhere from two to five clubs, associations and societies. Some of these are social, some are business. In the business and professional life of the tool engineer it is quite safe to say that no membership is of more value to him than his membership in the American Society of Tool Engineers.

The reasons are many. This organization was founded with a very serious purpose. It was founded not just to get a group of good fellows together, but to draw within one great professional circle serious-minded designers, production experts and engineers who wanted to pool their specialized knowledge for their own professional advancement and for the ultimate advancement of the great mass production industry.

A.S.T.E. had its most spectacular growth in membership during the wartime years. This was because tool engineers' exacting talents were in such great demand everywhere for the production of war goods and armaments. With the end of the war, it was reasonable to expect a sharp falling off of A.S.T.E. membership. This, however, was not the case. Our membership continues on the same high, wartime level, despite the fact that many members are changing jobs and that some are leaving the highly specialized field in which the tool engineer engages.

A great share of the continuing strength of A.S.T.E. and the value members place on A.S.T.E. can be accredited to the high type of officers and directors that have served A.S.T.E. since the Society's inception in 1932. They have placed service to A.S.T.E. on a much higher than just a prestige or a monetary basis. These men of industry have served and are serving willingly and gratuitously for quite another reason. They serve because they feel that this great industrial nucleus of engineering and designing talent and ability, classified under the general term of "tool engineering," is of inestimable value to the growth of industry and to the economic world in general.

Stripped of its technical aspects, A.S.T.E. is a sizable business. It is only natural that the membership should want to have that business conducted along business lines. After all, it takes some doing to organize and operate a two and one-half million dollar exposition, a successful technical publication like *The Tool Engineer*, a much-needed publication like the forthcoming *National Directory*, a comprehensive technical volume like the *Tool Engineers' Handbook*, and to keep operating smoothly the many member and chapter activities that stem forth from National Headquarters and from the various A.S.T.E. committees.

Your own enthusiasm for A.S.T.E. and your constant support of its chapter and national programs and projects show that you are in full appreciation of the value of your membership in A.S.T.E. And you can be proud, too, of the fact that despite the strenuous times of industrial readjustment this country is undergoing, A.S.T.E. membership remains not only high, but keeps right on growing and with the *right* men.

Am Sargent

President 1946-47

By B. P. Graves

Electric Controls Applied to Machine Tools*

Drives and Controls on Standard Machine Tools, with Special Adaptions to Standard Machines, as Seen from the Machine Tool Builder's Angle.

In designing Machine Tools for the general trade, the problem is much more involved than when designing a special machine for a particular product or operation. For the general trade, we must have a very thorough understanding of the market in regard to the field, the size, price (to meet competition), and general features and, at the final, we must have a machine that meets all these conditions and yet be acceptable to the operators. At the same time, we must constantly keep our manufacturing conditions and limitations in mind, and, as parts are carried through in quantity lots, to have them designed for most economical production. After these conditions have been studied, one who is familiar with the work can quickly decide what type, size, and drive is required to fill the requirements.

B. P. Graves **is a graduate of Rhode Island School of Design, M. E. Div'n, and an alumnus of Brown University. Entering Brown & Sharpe Mfg. Co. in '05, as drafting apprentice, he was subsequently appointed milling machine designer and, in '15, was promoted to his present position. He is a member of the A.S.T.E. (Little Rhody Chapter), of the A.S.M.E. and the S.A.E.; also, is affiliated with the Experimental Stress Analysis Society, the Army Ordnance Ass'n and the Providence Eng'g Society.**

To show that all designers do not think alike, just look over the machine tools in the same competitive field, and you will find mechanical, hydraulic and electric drives and controls and, recently, pneumatic.

You will find this same condition in the line of machines built by Brown & Sharpe Manufacturing Company. We have mechanically-operated milling, grinding, and screw machines; hydraulically-operated grinding machines and electrically-operated milling and grinding machines. We, at Brown & Sharpe, are beginning to term them Mechanical-Electric; Hydraulic-Electric, and Electric, because we find ourselves using a large percentage of electric motors and controls on all of the three types. As an illustration, we have mechanically-operated milling machines, with three motors and controls in their drive; hydraulically-driven grinders with four motors and controls, and electrically-driven grinders with nine rolling members—7 motors and 2 generators, with all their automatic electric controls.

In 1931, the writer made a European trip, starting with the Leipzig Fair, where he saw many machine tools of all sizes and descriptions, but the most striking thing was the *cylindrical grinding machine with headstock and table driven by hydraulic rotary motors*, just to obtain stepless speed control. Close examination disclosed an electric motor for the initial drive, an oil pump and then a fluid motor, and with all the valves and piping it looked very much involved.

**Resume of a paper, by the author, at the recent A.S.T.E. New Era Exposition, Cleveland, Ohio.*

FIG. 1. No. 12 Brown & Sharpe plain milling machine, electrically driven and controlled.

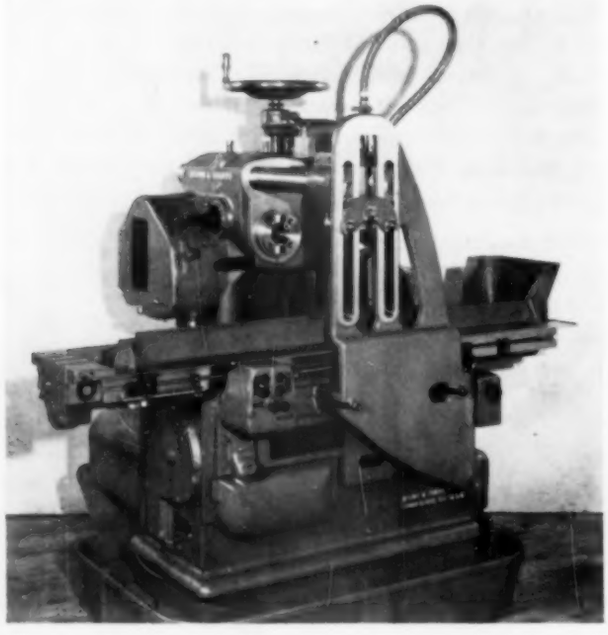
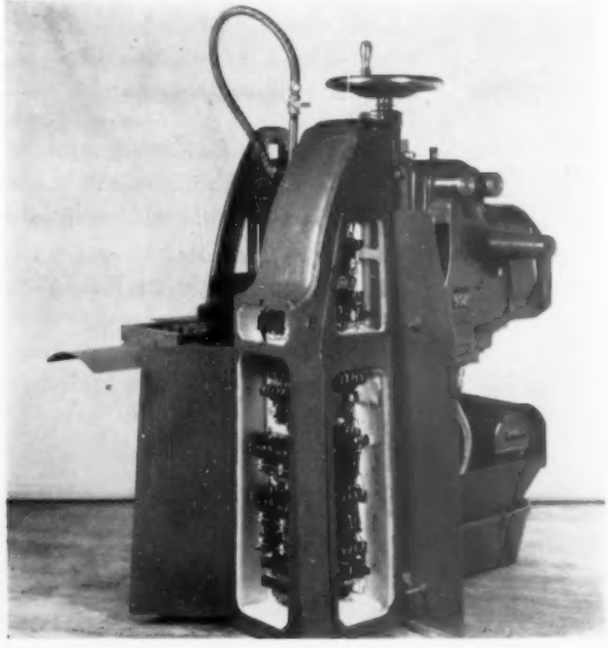


FIG. 2. No. 12 Brown & Sharpe plain milling machine showing built-in control panels.



On going around, and especially on the return boat trip, the thought came to mind that if individual motors are to be used to drive various units of a machine, it was a logical step in design to use more fully the abilities of these motors, to interconnect their controls and to coordinate their functions. Thus, instead of engaging and disengaging a clutch to start and stop a mechanism, the driving motor could be started and stopped. Instead of applying a mechanical brake, a motor may be plugged to rest, and in place of a reversing clutch, the motor could be reversed. So, the writer started plans for an all-electric machine, and as one of our small manufacturing-type milling machines was due for a revamping, we started on our *No. 12 Plain Milling Machine*.

This was no easy job and, being trained as a mechanical designer, the writer soon found himself in deep water; in fact, over his head. So, we went into the electrical field and engaged the services of an electrical engineer, who soon put the proposition straight, and here is what we finished up with. This machine has been on the market for several years and has proven one of the most successful machines we have built. See Figs. 1 and 2.

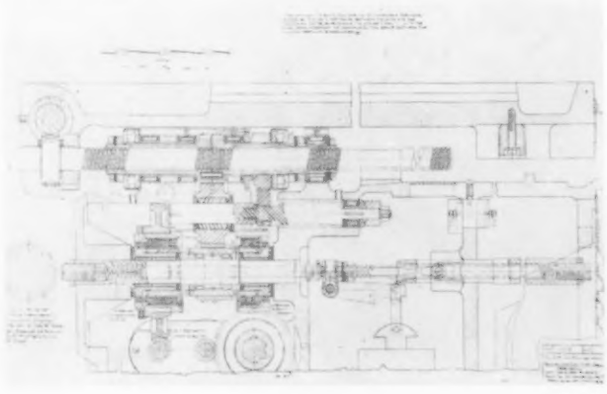
In a trip to the London Fair in 1934, and again to Leipzig in 1938, the writer noted that the design trend had changed and was working towards *electric drive* in place of the hydraulic as late as 1938, however, nothing seemed so completely electric as the milling machine now showing.

This milling machine successfully used the natural functions found in an electric motor. This is a plain manufacturing-type milling machine in which separate shell-type motors drive the spindle and table. The table starts, stops, and reverses with its motor. In stopping, the motor is plugged to rest or to the point where it actually makes a few revolutions in the *opposite direction*. The coast of a few turns in the opposite direction withdraws the work a few thousandths from the cutter, but has no influence on the point of farthest table advance or the point of reversal. By reversing and plugging the motor, it is possible to maintain with great accuracy, the point at which it is desired to stop a cut, or to reverse in the cut when cutting to a shoulder. It is well known that a small motor can stop in less than two revolutions when plugged.

A clutch, shifted by a solenoid, gives feed and fast travel rates of table movement. Using a solenoid to shift the clutch, it becomes comparatively easy to tie in the spindle rotation with the movement of the table. In a normal cycle, the cutter spindle will rotate only when the table is moving at a feed rate.

When cutting to a shoulder, the table feed is usually stopped by a shift from feed forward to fast travel in reverse. In this move, it is essential that the shift to fast travel be delayed until the motor has been reversed or, at least, has reached zero speed in its reversal. If quick traverse is engaged before this, the table will jump ahead, jamming the work onto the cutter.

FIG. 3. Solenoid shifting arrangement for clutch operating from feed to rapid traverse.



To obtain desired sequence of action, a viscosity-type plugging switch is employed. This is a switch which is controlled by the direction of motor rotation. The inner drum is mounted directly on the motor shaft running at 3600 rpm and the outer cylinder is rotated a few degrees by the viscous drag of .002 film of oil. Since a few thousandths' table drift away from the cutter is not only acceptable but desirable, the motor always passes through zero speed and makes a few revolutions in the opposite direction. A solenoid-operated detent prevents the switch drum from being carried through neutral to make contacts on the opposite side as would be done in a complete reversal.

The cutter spindle motor is plugged to rest. Here, the switch springs are selected to overcome the viscosity drag when the motor reaches the 500 to zero speed range. The plugging is stopped before the motor reaches zero speed but, in plugging a 3600 rpm motor to 500 rpm or less, 98% of the kinetic energy has been absorbed and a light-duty brake can be used to bring the motor to a complete stop and to hold it there. A solenoid releases a spring which applies the mechanical brake as soon as the viscosity switch opens the control circuits. See Fig. 5.

FIG. 4. Viscosity-type plugging switch direct to motor at 3600 rpm.

As a point of interest, both of these plugging switches operate at a speed of 3600 rpm and, when we started on this design, we were told that it just was not practical to operate a plugging switch at this speed. But, both these switches have been operating successfully since the start of the design. The present speed of commercial plugging switch seems to be about 900 rpm.

Making more complete use of electrical equipment, it is possible to adopt a two-speed feed motor. A switch, tripped by table dogs, selects the high or low table feed. With the possibility of halving or doubling feed rates at desired points in the cut, changes in depth or width of cut can be

FIG. 5. Solenoid operated brake after plugging spindle motor to approximately 500 to zero speed range.

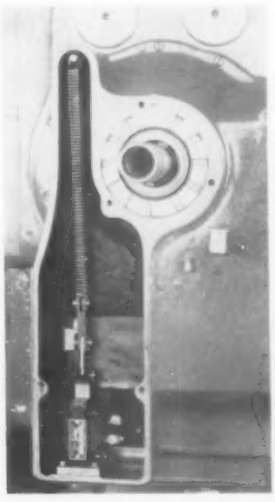
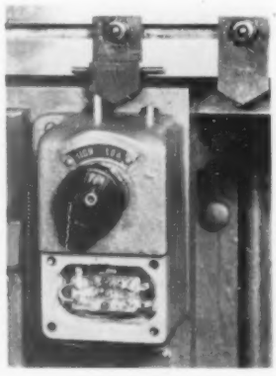


FIG. 6. Switch for two-speed feed motor, automatic or hand control.



more readily handled. Change of feed, during a cut, is a feature made possible by the use of electric controls. It is a feature which has not been offered in mechanical designs. See Fig. 6.

One other interesting advantage of an electrically-controlled machine is that the machine can be made inoperative as soon as any door or cover is opened. The doors of the spindle and table gear cases of this milling machine both open motor control circuits and make it impossible to accidentally start the machine while gears are being changed. See Fig. 7.

Our second attempt was the electrically-driven and controlled *plain grinding machine* shown on Fig. 8. It is probably the most completely electrified of any standard grinding machine now made. It employs seven motors and two direct current generators, the direct current being used for adjustable speed drives. Briefly described, the machine has five constant speed motors which are connected to the line and which may be AC or DC depending on the power supply. These constant speed motors are: 1) Spindle Motor; 2) Headstock Motor; 3) Table Motor; 4) Coolant Pump Motor; 5) Lubricating Pump Motor; 6) Wheelslide Quick Return Motor; 7) Generator Motor. (This runs whenever the machine is in operation and drives the two direct current generators.)

Of the two generators, one is a constant potential machine and the other a variable voltage generator which is used in a Ward-Leonard table drive. The constant voltage generator supplies power for relays and contactors and for the fields of the variable voltage generator and motor. In addition, it feeds the adjustable speed motor used to drive the headstock. Speed is changed through a 4 to 1 range by a rheostat connected in the field circuit. When the motor circuit is opened, a resistance is placed across the armature and rapidly brakes the headstock to rest.

The table motor is controlled by a rheostat in the field of the variable voltage generator. Reversal of the generator field reverses the table motor. This Ward-Leonard drive was chosen because table loads were essentially constant torque loads, and because a low-speed motor having a small kinetic energy, could be readily reversed.

Since reversing contactors handle only the small generator field currents, light control units can be used. Speed changes of 4 to 1 (900 to 225 rpm) are obtained in the high gear drive and 8 to 1 (900 to 115 rpm) in the low-gear drive. To obtain an accurate reversal in the high-gear series, the motor is slowed down to a fixed low speed just before the reverse contact is tipped.

The outstanding advantage of a completely electric machine is the opportunity given to interconnect the controls of its various units. Controls can be simplified and coordinated, safety features can be easily incorporated, automatic control becomes possible, and in general, the machine becomes more responsive to the operator. In the writer's belief, no other method of control can so easily tie together the various elements of a machine. This is the function of electric control which should receive greater emphasis, and it is here that the electrical engineers can do some helpful work in the machine tool industry.

Light-type Miller

Next, we undertook the redesign of our light-type, knee-type milling machine (Fig. 9), with the thought of incorporating many of the electric possibilities.

We have made use of two motors of the flange-type, one for the spindle drive and one for the feed drive, and a third motor when coolant pump is desired. By doing this, we have made it possible to make use of the natural function of the motor, namely, *start*, *stop* and *reverse*, and have avoided the necessity of using a friction drive, or a mechanical reverse, a drive from motor to drive shaft, or complicated drives from main drive to knee. At the same time, we have made

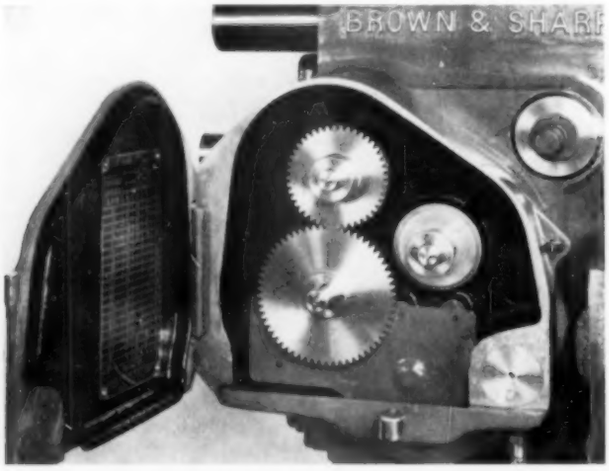


FIG. 7. Safety control feature when either change gear door is open.
FIG. 8. Electrically-driven and controlled 10" plain grinding machine.

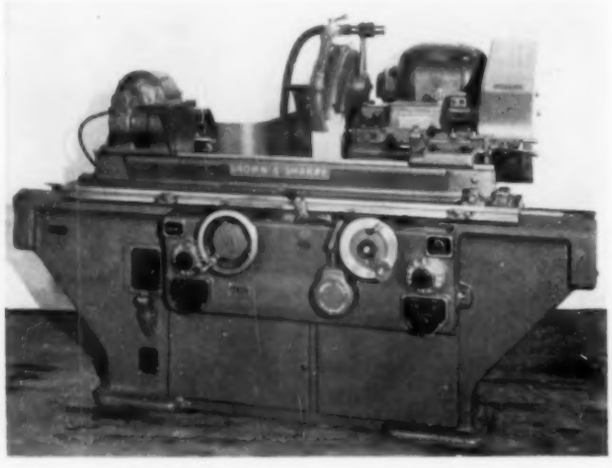
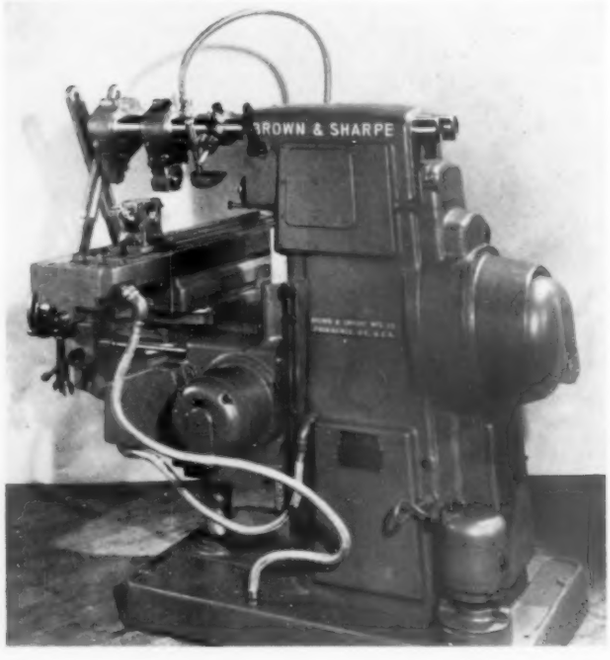


FIG. 9. Knee-type milling machine, operated and controlled by independent speed and feed motors.



it possible to run the spindle motor in either direction without influencing the feed drive. This, like the other electric application, has proven most successful.

This photo also shows our latest attempt to meet the new N.M.T.B.A. Electric Specification on controls, all in one compartment in which are included disconnect switch door interlock and transformer for 110 volt on control circuits. Here, the lowest working point in control box is to be at least 8" above the floor.

3" Plain Grinding Machine

Fig. 10 shows a small plain grinding machine of the electric-mechanical type, designed to meet a particular field, which has proven most successful. This machine, although a mechanical drive, is driven by five motors: wheel, headstock, feed, pump and, when desired, wheel rapid movement. In designing, we studied it very carefully and decided that, for the features required and the field to be covered, the mechanical drive was best suited.

You may ask why this machine is not all-electric like the previous grinder. You will note that this is a small machine and that it has physical limitations in regard to incorporating all of the necessary motors and controls, especially as there is very little difference in the dimensions of motors and controls required for this machine and those required for the larger machine. Also, there is a limitation as to the amount of money to be spent on electrical equipment for a machine of this size; and here again, the price differential of control for the two machines is very small indeed, making it prohibitive to consider all-electric. This also shows our attempt to meet the new electrical specifications.

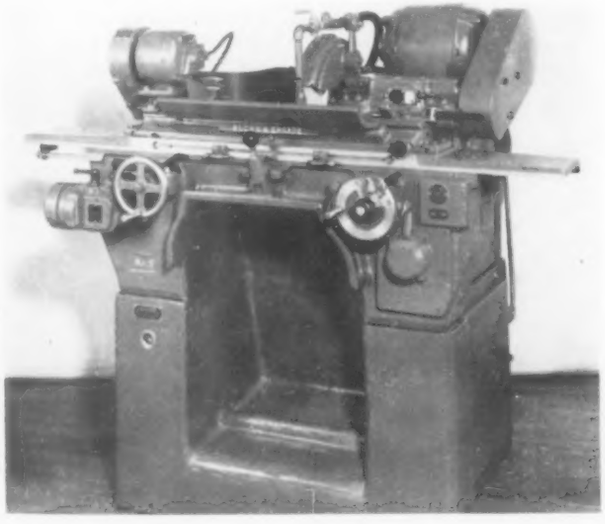
6" Plain Grinding Machine

This Cylindrical Grinding Machine has a hydraulic table drive, but the balance is electric-mechanical, and was so designed after a very careful study of all these drives in order to meet a competitive field. This machine, you will notice, is not so versatile in its set-up possibilities as the all-electric machine. In this machine we used four motors, one hydraulic pump, and cylinder and piston. Here again, because of the cost, we had to abandon the thought of an all-electric, so, chose the hydraulic table drive in order to obtain a stepless speed table drive. See Fig. 11.

8 x 24 Surface Grinding Machine

This is a hydraulically-driven Surface Grinding Machine, and the principle thought, back of this design, was to obtain a stepless table speed arrangement which proved less costly and more practical than an electric drive. See Fig. 12.

FIG. 10. 3" plain grinding machine—electric-mechanical design.



In working up a machine of this type, we considered an electric motor drive to the table, endeavoring to use the natural reversing feature, but found that the required reversals, in order to cover the minimum length of table stroke per minute, were too great for the motor. At the same time, the standard electric motor limited us to a single table speed.

No. 2G Automatic Screw Machine

This machine is a complete mechanical drive, operated by cams and clutches, the operation of each function being mechanically timed. We have studied many types of drives, but have been unable to arrive at a design that proved as acceptable for accuracy of performance, stability and ease of set-up, and as trouble-free.

This machine is driven by an electric motor in the base of the machine to the spindle drive. It is also arranged with plug-in receptacle to receive motor-driven attachments, making it possible to change or remove attachments with little effort.

The rod magazine attachment for our smaller size machines has been changed from mechanical to motor drive. By doing this, we have obtained an attachment that is much easier to apply and, at the same time, much easier to set up, and we also obtain a feature of manually operating the rod to position by means of a crank on the driving motor.

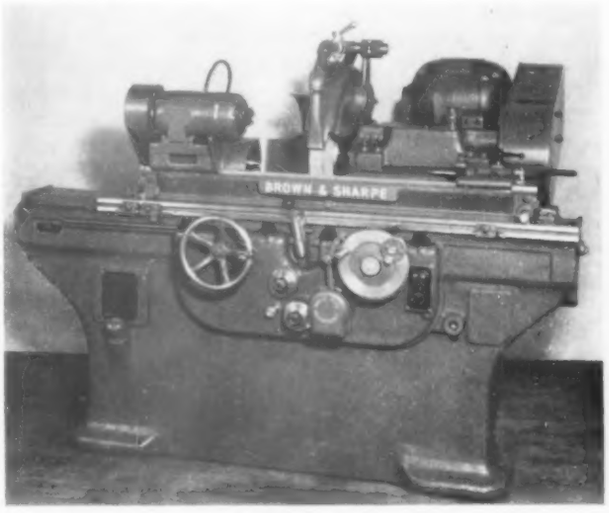
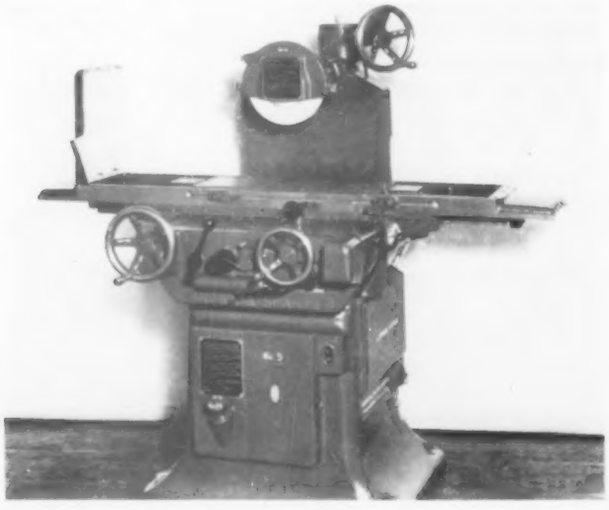


FIG. 11. 6" plain grinding machine—electric-hydraulic design.

FIG. 12. 8 x 24 surface grinding machine—hydraulic table drive.



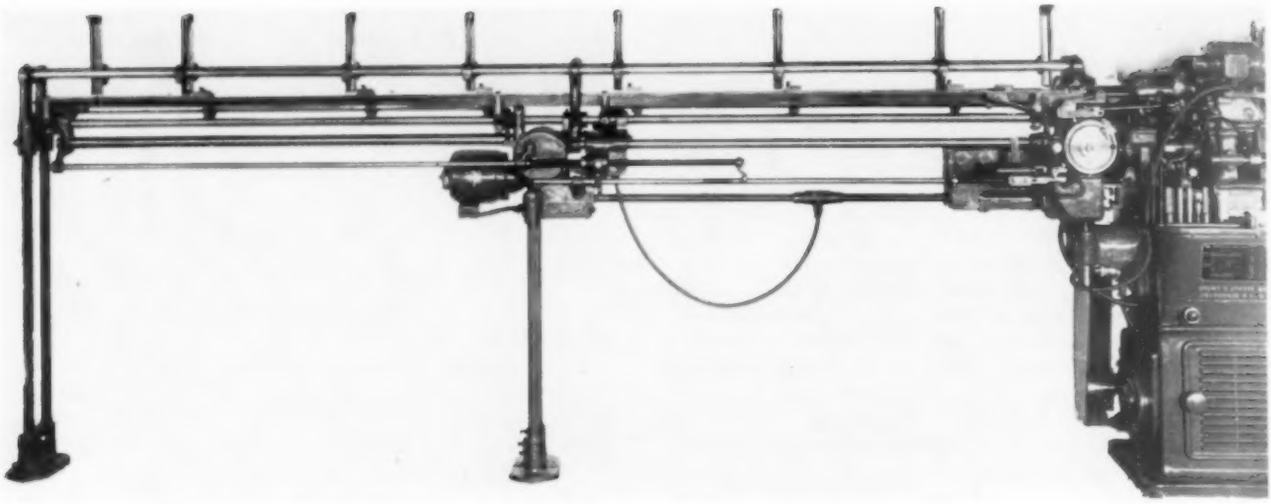


FIG. 14. Electrically-driven rod magazine.

FIG. 13. No. 2G automatic screw machine, electrically driven, of mechanical design arranged with plug-in receptacles for motor-driven attachments.

At Brown & Sharpe, we do not consider building entirely special machines, but we do consider special work where it is possible to use a large percentage of the standard machines, or where the machine can be arranged with special fixtures with a tie-in with the machine control. We have furnished many machines fitted with special mechanical, hydraulic, and pneumatically-operated mechanisms. On our grinding machines, the special features seem to run to mechanical except for chuck operation where pneumatic or electric operation is used.

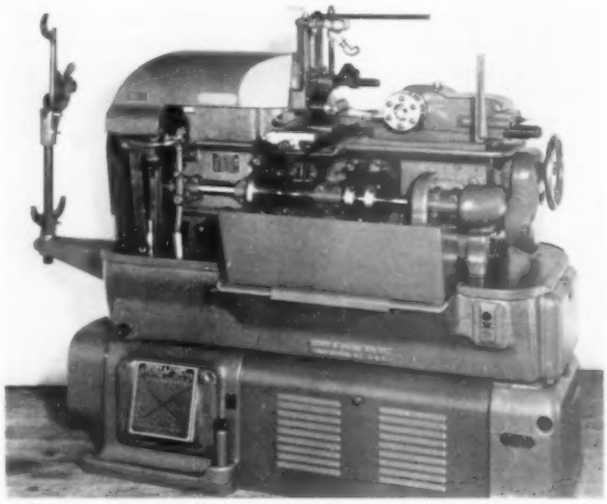
On our automatic screw machines, most of our attachments are operated electrically because of the fact that, many times, it is desirable to remove the attachment with each change of job. In order to assist this change or removal, we can furnish our machine with plug-in-receptacle, so the attachment and motor complete can be removed intact.

On special fixtures, for milling machines, we get the largest variety of drives and controls. Where there is any question as to type of drive or operating mechanism, or where we feel there is wide choice as to what drive or control we can use, we usually give our customer an opportunity to state his preference. In all cases where, in our opinion, air operation is superior, we definitely put it up to the customer for his approval because of the fact there seems to be some hesitancy on the part of many customers to the use of air for machine operation.

Torque motors have found a place for operating indexing fixtures. Mechanical drives can be worked up very simply, and air-operated fixtures have proven to be very effective and reliable. A few slides will better illustrate the possibilities.

Flanged Motor

You will note that we have made use of the Flanged Motor—in the writer's mind, to good advantage. This type of motor fits into the general scheme of things, saves a great amount of expense and mechanism, and adds greatly to appearance.



In looking over THE TOOL ENGINEER for February, the writer noticed that one of our machine tool engineers was brave enough to say that some of the larger corporations are retarding progress in machine design by refusing to accept flange motors, or by forcing the customer to make a special plea for their acceptance.*

We certainly go along wholeheartedly with his remarks, and hope that more serious thought be given to their acceptance. It is sound engineering.

*Page 56, A.S.T.E. News: Talk by Myron S. Curtis at Rochester Chapter.

Motor Cooled With Gasoline

Electric motors are sometimes found in strange environments. For example, a motor developed by Westinghouse to drive a booster fuel pump for a jet propelled plane is mounted—of all places!—inside the fuel pump itself. However, it is explosion proof, and is cooled by means of gasoline or kerosene (whichever is used) circulating between an outer housing and the frame. The motor, which weighs a scant 20 pounds, develops 2¼ hp at 8000 rpm.

Motor Industry Facts

Personnel records of passenger car makers reveal that 31,514 men and women have employment histories dating back 20 years. An additional 17,000 have worked in the motor industry a minimum of 25 years, and at least 439 persons have been on automotive payrolls between 35 and 40 years. In 1896 there were only 16 cars registered in the U. S. Today, on the 50th anniversary of the automotive industry there are 25,500,000 cars.

By L. R. Twyman

Hydraulic Controls and Drives*

A Fundamental Approach to the Principles and Advantages of Hydraulics as a Power Medium

Psychologists tell us that engineers—all engineers—react mentally much the same as do other human beings. And engineers, being humanly compliant, will subconsciously react to considerations other than those deriving from the hard cold scientific facts, even though they would be the last to admit it. It is a rare engineer who, in his selection of methods, is not influenced by his educational backg. und, his own personal experience and his current reading matter.

In the field of power transmission, application and control, there can usually be four general methods considered—mechanical, hydraulic, pneumatic and electrical. We all wish to study these methods strictly on their merits and to select the best for the job to be done without prejudice and without deference to any styles of the moment.

L. R. Twyman **joined Vickers, Inc., in 1932, and has acted as Field Application Engineer, Advertising Manager, Manager for Product Development Engineering, Assistant Sales Manager, Manager of Public Relations. Currently, he is Manager of the Vickers Industrial Div'n. Broadly experienced in the machine tool field, and especially on special purpose machines, he has been active in developing hydraulic appliances during the past fifteen years.**

All these methods have their merits, and through the years certain types of jobs have become recognized as particularly suitable to one particular method. However—and this is perhaps why the matter is up for discussion—there is an extensive middle ground of jobs which could be done by more than one of the accepted methods. It is this possibility of different ways of skinning the design cat that makes the subject interesting.

This discussion will be initiated, then, on the basis of reexamining a few fundamental approaches to the problem of selecting a proper control method. No matter how much we talk about design niceties as found in all the types of power transmission and control equipment, we can only contribute substantially toward the problem of logical selection of the right method for a given application when we brush aside many of these details and get down to considering some underlying principles.

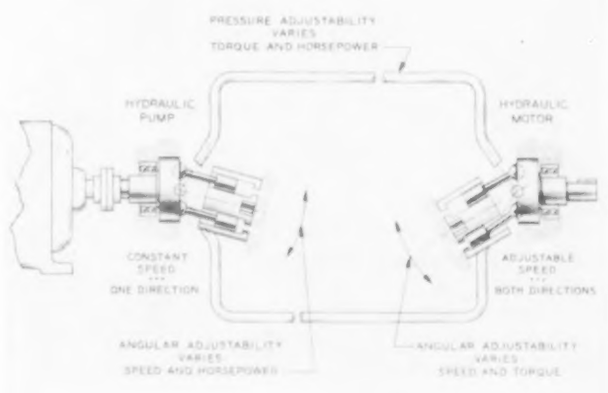
You will doubtless say that this is an obvious point to the technical mind. It presumably *is* obvious, but a tally of final accomplishments often show that the psychologists are right in that the technical mind is just as human as other minds, with the result that it will follow styles and modes and preconceived paths. We, who are of the engineering profession, would like to think we are immune to this! We all like to try mysteriously new methods when we are tantalized by the advantageous possibilities they possess, and it is only after we try them to the point where their weaknesses also become apparent, that we retrace our steps and begin giving fundamental principles a second look with more careful scrutiny.

Nowhere, perhaps, do the importance of elementary factual comparisons apply more than when hydraulic control methods are considered. Hydraulics as a mechanical agent is one of the oldest means of handling energy. The very earliest mention of mechanical things, 'way back in the mists of antiquity, concerned simple hydraulic apparatus for the handling of water. But hydraulics as we are speaking of it today had its first real impetus at the dawn of the Industrial Revolution when Joseph Bramah applied the plunger type force pump to his newly invented hydraulic press in 1795. During the course of its long history many of the basic advantages of hydraulics as a power medium are forgotten because they have been to a great extent taken for granted.

When we consider the wide range of possibilities, and the wide range of available equipment, the technology of applying hydraulic systems is found to be so vast that it will fill a very sizable volume. This is one reason we will not dwell at this time upon any of this class of details of the subject. Another reason is the fact that it possibly would be most timely to review, for a change, the elementary principles that are so basic, perhaps making them interesting by studying them in a new light.

Hydraulic power has been used on many jobs where it should not have been applied, but hydraulic power is not used in a lot of places where it deservedly should be used. While it is interesting to carefully consider the niceties, refinements and more involved applications of hydraulic

FIG. 1. **The basic hydraulic adjustable speed principle, as applied to rotary drives. Any desirable combination of r.p.m., torque and transmitted horsepower variations, in stepless increments, may be provided by simultaneous or individual adjustment of the three factors indicated.**



**Resume of a paper presented at the recent A.S.T.E. New Era Exposition.*

systems, it will be of the most general interest if we brush aside these and instead think about some beautifully simple, but perhaps intriguing, elementary concepts.

As the quickest way of reviewing these fundamental principles two concrete examples have been selected for brief discussion. First, suppose we isolate for attention a certain drop of oil. If we verbally color it and put it with a lot of others, into a hydraulic system that consists of a rotary pump, a rotary fluid motor, and two interconnecting lengths of tubing, we can trace its movement as we put it to an amazing variety of uses.

Input and Output Balanced

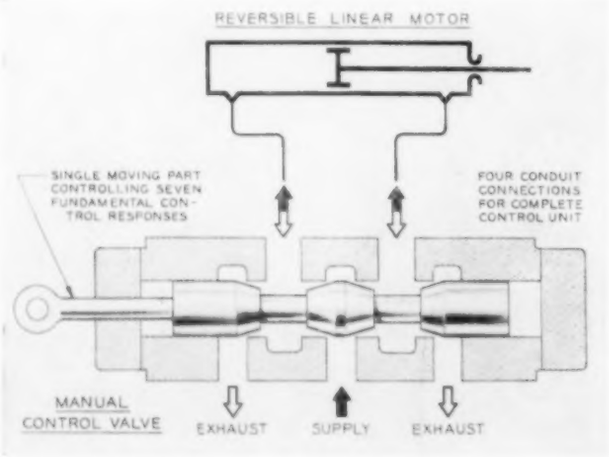
Primarily let us consider this drop or molecule of oil, within itself. It cannot be compressed appreciably, but it will flow in such a way that it will follow all the contours of any containing surfaces. With a progression of other such "drops," it thus can be used to transmit a positive thrust effort around bends, through large or small tubing connections, into and out of fluid motors, or to apply this force as it may be needed at any most convenient point. A "push" at one end of the tubing produces an equal displacement and pressure at the other end. The energy we put in is equal to the energy we get out (neglecting fluid friction), and we see that we can set up a powerful energy transmitting means within a tube that is self lubricating internally and positive in its action. There is no external motion whatsoever which would require safety guards, housings, bearings or supports.

In transmitting this power, we do not need to transform it through heat conversions, electro-magnetic conversions, or through other physical conversions that would tend toward degradation of energy and consequent dissipation and partial loss.

These facts indicate, then, that we can transmit a great deal of power very conveniently and simply with our oil that is moving under pressure, but now how about using it in the form we want it and controlling it to our best advantage?

Often it is desirable to increase torque and reduce speed. When we think of hydraulic systems we do not think of gear trains or belts, all we need in hydraulic systems is a ratio of effective working *areas* that is equal to the ratio of the speeds or the ratio of the torques. Our rotary pump at one end of our two lengths of tubing will displace a certain amount per revolution, and if we would like a fluid motor at the opposite end of these two lengths of tubing to revolve at one-tenth the speed and ten times the torque, we would provide a hydraulic motor that has a displacement per revolution of ten times the displacement per revolution of the pump. No extra parts are needed, no additional bearings are needed, we simply make one displacement larger than the other by the ratio required.

FIG. 2. **Simplicity is shown by this diagram, wherein one moving part and four (two exhausts are combined) conduit connections are all that is required to obtain seven fundamental control responses.**



Do we wish adjustability of speed? Quite often it is a must, and much more often it is a great advantage if we may get it economically. In this case we select a type of fluid motor that can be varied as to its displacement per revolution. When we adjust this displacement the rpm of the hydraulic motor varies accordingly. The power being delivered to the hydraulic motor is constant, as the circulation rate and the pressure is kept constant, and our drop of oil which we are watching is circulating from pump to motor and back to pump again at a continuous rate of motion.

Mechanical limitations prevent effective fluid motor adjustment in a ratio of more than four and one-half to one, but additional speed adjustment of infinite range may be obtained by also using a pump of the adjustable displacement type. It is obvious that if we reduce this pump displacement rate our circulating drop of oil will slow down and will not get around its circuit so quickly. The fluid motor, meanwhile, for a given displacement rate, will likewise slow down proportionately.

With this condition, assuming that we do not increase pressure in the system, our torque is constant and the horsepower transmitted decreases with a decrease in fluid motor speed. Under these circumstances, should we wish to keep the rate of transmission of power a constant, we must resort to higher pressures. Said in another way, if our versatile drop of oil is being pushed along at slower speed, it obviously must be subjected to a higher pressure to keep the rate of power transmission the same. But, in whatever combination of flow rate, pressure and displacement per revolution we choose, we now have an adjustable speed power transmission, with horsepower, torque and speed characteristics controllable at our will, and in any of the desired combinations.

The Ultimate in Flexibility

Let us not forget that our drop of oil can flow around its circuit in the opposite direction, too, and in the same variably controllable manner as we followed it when it was moving in its previous direction. The variable displacement pump, with no additional parts needed, will deliver oil in either direction of flow, and any rate from zero up to maximum in either direction, even though its drive shaft is being driven at a constant rpm in one direction only. At the intermediate position the flow stops, and the flow rate gradually increases as the pump is offset one way or the other from center. The fluid motor at the opposite end of the interconnecting tubing will therefore reverse, stop, or change speed accordingly, and can handle power at all times with the various combinations just previously described.

Here is the ultimate in flexibility, and we are still using the same basic system components with no energy transformations other than hydromechanical being necessary. Our constant-speed in one direction power, as delivered by the electric motor, is hydraulically changed to adjustable speed, adjustable torque, variable ratio, reversible power.

Now, as to the matter of control. We have found that our power can be applied conveniently, and that it is as flexible as we could possibly wish. Suppose we replace the manual stroke control of the pump or fluid motor by a small cylinder and a piston, with the effective piston area tied in with the interconnecting power tubing conduits. This gives us a new type of system. We now can obtain auto-

matic regulation of speed, automatic regulation of torque if we would rather, or automatic regulation of horsepower, should we desire. All this, by changing only a single moving part!

Our drop of oil can be controlled by other means, too, in fact many of them. As an example, one very intriguing class of application that can be beautifully controlled by a hydraulic system of this nature is the job of constant tension winding. This problem is one where unwinding rolls are constantly diminishing in diameter, winding rolls, on the other hand, are constantly increasing in diameter, the processing machine speed is meanwhile adjustable and the machine is subject to stopping and starting. Under all of these conditions, the tension on the material being processed must always be automatically held constant. This task can be handled by rotary hydraulic drives to a high degree of sensitivity, and, upon occasion, is accomplished without the need of rider rolls. The hydraulic system is one which automatically accomplishes the results under the various operating conditions without need for any supplementary system of electrical or other type of controls. Sensitivity of response, as in all cases, is primarily a problem of reducing inertia to the minimum. When hydraulic methods are used the inertia is always low by reason of the compactness and lightness of weight of the rotating parts as compared with their given torque and rpm ratings. Directive corrections may thus be followed before errors, due to acceleration or deceleration lag, become so great.

It might also be mentioned, in passing, that automatically controlled rotary hydraulic drives find diversified use for hoists, machine tool cutter drives, processing machinery drives, and reversing drives for large machines that are of such long stroke that linear motors or cylinders are not adaptable. Much interest has recently been focused upon automatic speed or feed regulation in response to fluctuation of cutter horsepower. This is most readily accomplished when the cutter is driven by a hydraulic motor, for then the feed and drive interrelationship may be hydraulically interconnected without need for supplementary controls.

We'll have space for only one other fundamental analysis that illustrates the directness and simplicity characterized by hydraulic power methods. Perhaps we should call this illustration "An ABC Story of One Moving Part." This time let us look at a portion of a very typical hydraulic system. By way of variation we will illustrate this case with a linear motion hydraulic motor (or cylinder) instead of a rotary design, and will use a part of an "open" circuit rather than a part of a "closed" circuit. Of primary importance is the fact that a single moving part, working under no unbalanced load, and wholly enclosed in a pressured oil chamber, can perform so many control functions.

Here we have a directional control valve, which receives pressured oil from a pump, and is capable of diverting this oil to either or both ends of a cylinder, and allow for the discharge of oil to a system supply reservoir. The one moving part is a "spool" that can be designed to function with respect to the valve body porting in order to divert flow in various ways for corresponding spool positions. No doubt most of us are quite familiar with this general type of valve and some of its functions, but have we stopped to actually think of the multiplicity of things accomplished, when considered in the light of doing the same thing by other than hydraulic means. And, especially, have we considered how many things are accomplished in view of the fact that there are but four conduits or connections, leading to the control unit.

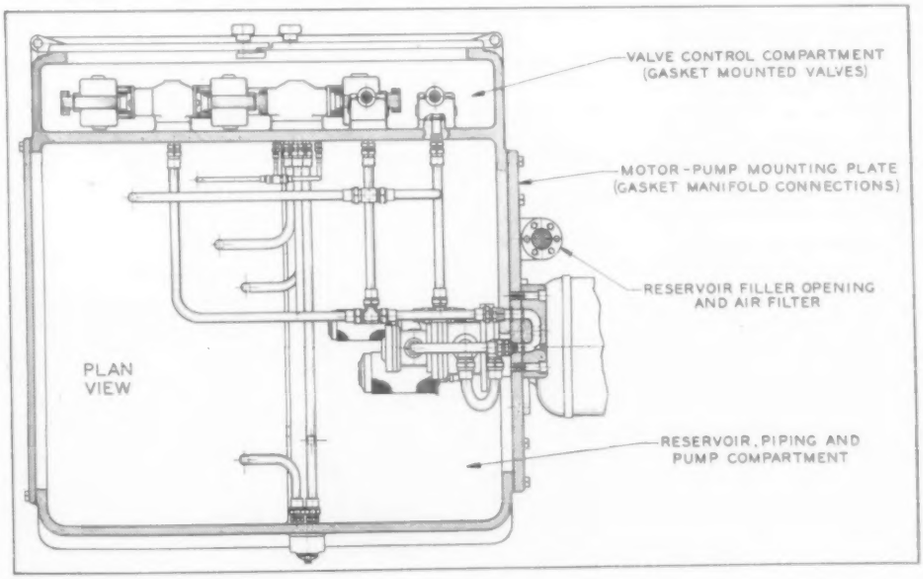
Control Functions Classified

Our one moving part, if we assume it to be manually operated, could control tons of thrust resistance at the cylinder, and in order to fully realize how flexible this control may be, we can segregate or classify the control functions as follows:

First, we have start and stop control, and for the stop control we may stop suddenly if we desire, and have the equivalent of what is often termed "plugging" with electric motors. Secondly, we have smooth "inching" or "jogging" control that is of sufficient continuity so that the operator definitely has what he calls "feel." Then, too, we have acceleration or deceleration control, or, that is, we can bring our load up to speed smoothly, or decelerate smoothly, too, if we do not wish a "plugging" type of stop. Our same valve spool acts as a reversing control, and will handle this reversal at either a high or a low speed under heavy inertia loads. Further, our valve can be used as a position holding brake.

A sixth set of conditions that can be met by the same valve spool is that it can allow the hydraulic motor to "float," should the requirements call for this. All this we are getting from our one moving part, and, as a matter of fact, more too. For, with slight modification of the valve porting we can get a two-speed or "differential" advance when employing a linear motor. Further, if we mount the entire valve on a floating assembly, our same valve spool will give servo control, which is almost human in the eyes of the layman. The slightest offset of the controlling lever, measured in thousandths of an inch, can be duplicated or amplified at the cylinder piston rod. Thus it will be noted that an effortless manual action is duplicated with tons of thrust being potentially available. Or, as another case, a remote electrical control delivering an ounce-inch of torque can

FIG. 3. Separate compartments for valving controls and piping, with gasket mounting provisions on the partition, permit accessibility through panel doors without disturbing piping connections.



be multiplied hydraulically to handle torque load reactions of many thousands of inch-pounds with unbelievable accuracy of duplication.

Many old timers might summarily comment "Why, what you are saying about some of this is that we would get the same controllability as with a steam engine throttle." In that statement they would be correct, except, of course, that accuracy of control using a liquid could be much greater than when using a vapor or gas under like conditions. However, steam as a prime mover is almost a stranger to many machinery designers and engineers of today, and the deservedly high praise so often heard in older days for the nicety of steam control is now heard only in a few branches of industry where steam engines are still commonly used. There are thousands of machine operators today who have never enjoyed the "feel" of that controllability that comes with steam.

Epitome of Design Efficiency

When we can obtain this same nicety of control in a hydraulic system with a single fully enclosed moving part, which is within a self-lubricated and sturdy valve design, and which has the fundamental simplicity that requires only four conduit connections, we have the epitome of design efficiency. Let us repeat—seven fundamental control responses, with one moving part and but four conduit connections. When we do this hydraulically, we accomplish so much so easily, with such sturdy and simple units, that many of us are prone to skim over the possibilities in search of something more intricate and expensive.

Our versatile valve may be equipped with other than manual controls. If we use pilot pressure on the ends of the spool we can provide very high speed automatic reversals. We may wish to mechanically actuate the spool by cams, for automatic sequence changes, or, we possibly may desire to shift the valve spool with solenoids in order to readily tie in with electrical circuits. In putting a happy ending to our story of the "One Moving Part," we should admonish ourselves not to forget that sometimes a single moving part, properly applied to the job at hand, can possibly accomplish the work of many parts and much complexity.

In very hurried fashion, so that but very little space is consumed, we should summarize some new trends and developments in the field of hydraulic power systems. Even though the principles are simple, the application is a vast field that needs a wealth of practical training and experience and up-to-date technique.

On the subject of dirt removal, new micronic filtering methods have shown steady improvement during recent years. Much was done in this line for aircraft hydraulic applications, and, in the near future, there will be announced a novel filter that can be installed in a high pressure line. This has advantages in certain types of circuits over low pressure intake filters, and promises to be a good item of insurance against the difficulties sometimes caused by dirt. Yes, it is true, dirt in hydraulic systems is no more desirable than in bearings, gears or elsewhere on moving machine parts.

During the last few years there has been a great deal of talk about the accessibility of hydraulic systems by users of machine tools. Only the hydraulic motor need be applied where the brute force of power is utilized, but sometimes machine designers are as neglectful about the accessibility of some of the other hydraulic units as are the designers of automobiles in making many vital automotive parts readily accessible. Then, too, many designers may have had such good luck with previous hydraulic applications that they evidently have felt they can completely bury them within the machine!

The answer to this problem is largely in the hands of the machine tool or machinery designers, but the trend will be toward the use of more gasket mounted hydraulic units, placed in hydraulic control compartments where they may be inspected by merely swinging open a door. This will eliminate most of the complaints on the matter of accessibility. These gasket mounted valves may be removed by merely loosening a few cap screws—there are no pipe fittings to loosen. The pipe connections are permanently made to the reverse side of the mounting wall, and frequently within and above the oil sump, so that even if there were a few drops of leakage in the piping assembly, it would never be noticed.

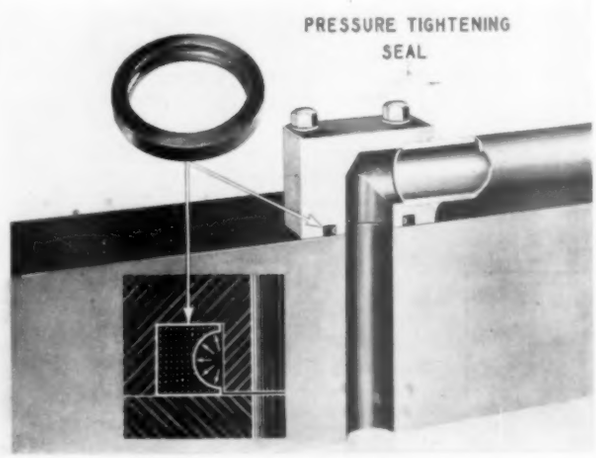
Now we can turn to one other bugaboo that is heard with some regularity, namely that of leakage. Sealing methods have been a retarding influence toward making full use of the advantages of hydraulic methods on many occasions for many scores of years.

Much has been accomplished recently along these lines. The so-called "O-ring" seal, the pressure tightening "Vickerseal," and a new, soon to be announced, rotary shaft seal are all representative of current progress toward elimination of leakage at high pressures. Pipe threads have been a source of a great deal of trouble, and as a result they are losing favor rapidly in this class of usage. For the higher pressures at which hydraulic systems operate we will find flanges, with new gasket sealing methods rapidly displacing some earlier methods.

Low Weight Per Horsepower

Many people ask about the influence of lightweight hydraulic design as primarily developed for aircraft usage. It is quite possibly true that sizes of units will be decreased to a certain extent, and with this pressures increased to a certain extent. However, as to whether or not a trend toward lighter weight and more compact units for machine tools is anticipated, it is difficult to predict. There are many engineers who do not like to go to fragile or abnormally small control units for machinery applications where the weight and size is not of appreciable importance. It must always be kept in mind that service life expectancy is much, very much, longer for industrial applications than for aircraft applications, so that pressures and speeds are much more conservative in the former. Industrial equipment units must therefore be, in general, larger. Hydraulic equipment has a very definite lead on other methods of power transmission when considered on the basis of low weight per horsepower, or low inertia per inch pound of torque, and

FIG. 4. Pressure tightening seals make gasket mounted units and flange type piping connections practical for hydraulic systems.



it is doubtful whether this advantage should be pushed to the extreme for machinery applications. As an illustration of compactness, lightness, and low inertia of hydraulic units, it often is quite effective to produce, from one's pocket, a ten horsepower 3600 rpm rotary hydraulic motor which develops 2.5 hp per pound of weight.

One more trend deserves mention, and that is the idea of unitized construction in hydraulic equipment. We doubtless will see more small reservoirs that have a pump, control valve, and in some cases, even a fluid motor, all built as a single unit for application as one integrated item. This has advantages for certain types of applications and is an influence worth noting. This works hand in hand with the advantages of unit standardization.

We should not neglect to mention that many improvements in hydraulic oils have been made during recent years, and that now other liquids too are available that have adequate lubricity and most of the other hydraulic characteristics necessary, while at the same time possessing non-inflammable characteristics. These have been of particular interest to the die casting industry, as a means for prevention of fires in case of breakage of any high pressure line that is not protected.

In concluding these comments, several thought provoking points should be emphasized. This presentation has purposely stayed away from details of application in order to focus more attention upon fundamentals. Such a subject is too voluminous for any brief article and it would introduce matters not sufficiently broad in scope to interest readers with diversified problems. This must not be construed as minimizing the importance of application techniques. They are all important, and many a job where the general principles are right has not lived up to expectations because of lack of attention to some small detail.

Designers have accomplished some wonderful things, first, to meet the necessities of war and now to meet new competitive conditions. Their horizons have been widened by the challenge of many jobs that simply had to be done and are yet to be done.

We have mentioned that all of us are human, even engineers, but during these last few years we simply have not been able to afford the luxury of indulging in a selection of methods on a basis of personal preference or style. While keeping an open mind for new advancements, we have found that new and better ways of applying principles known for centuries has quite often been the most practical and most satisfactory answer.

FIG. 5. Fast control response is basically a function of inertia. Accuracy of control is thus directly dependent upon low weight per horsepower transmitted, or low inertia per inch pound of torque developed. The hydraulic motor above develops 2.5 h.p. per pound of weight.

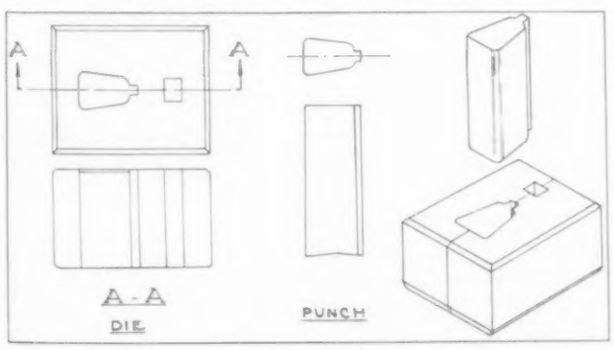
Nearly all the principles governing hydraulic forces have been known for a long time but the application of these principles is still practically in an adolescent stage. We hope that we have demonstrated with the few fundamentals discussed that hydraulics have desirable simplicity even for complex accomplishments. They provide extremely fast, smooth reversal and can be stalled indefinitely under load without damage. They have an amazing flexibility of power application. They offer an overload protection that is simple and foolproof. They offer sensitivity and precision while at the same time being rugged and self-lubricating.

These inherent advantages are a challenge to the enterprising designer who puts power to work.

Economy With Carbide Dies

A fifty-fold increase claimed in punch and die life, together with the complete elimination of undesirable burring of the blanked metal, are gains reported by the *O'Keefe & Merritt Mfg. Co.*, of Los Angeles, following installation of punches and dies of Carboloy cemented carbide for the manufacture of stator laminations for electrical motors.

The operation at O'Keefe & Merritt involves piercing laminations in Electric and Armco grade annular steel discs having a 2.50% silicon and a .12% carbon content. Stock is between .016" and .018" thick. Prior to piercing, the steel is heat treated in order to produce a tight scale which, although it materially increases the abrasiveness of the stock, has valuable insulating properties in the completed generator.



Laminating is performed on an indexing V. O. press operating up to 600 strokes a minute. No lubricant is used. The carbide dies in current use are made in two pieces, clamped together, and identical in construction to the steel dies formerly employed. The die is sharpened by grinding the top, while relieving each half, after grinding, maintains correct size. Only the sides of the dies have clearance; the ends are straight. The face of the punch is concave, for shearing. Carboloy Grade 55B, a shock resistant grade of carbide in general use for blanking work, is used for both lamination punches and dies.

Production records show an average of 46,000 punches, between re-grinds, on the steel die, against 1,600,000 to 2,304,000 pieces for the Carboloy dies. None of the latter have as yet worn out, so total life cannot be exactly computed.

By John E. Huyler

Oil Grooving Operations

In which the Author Discusses Various Methods for Cutting Oil Grooves, Adaptable to Both Jobbing Shops and Mass Production Plants.

The importance of correct oil grooves has led mechanics everywhere to look for grooving methods that can be advantageously used in their own shop. Naturally, the size of a shop, the volume of oil grooving to be done, the particular size and type of parts to be grooved, and other factors, enter into the choice of method. In a few instances, modern arbor presses have been used for this duty, and the scope of such presses—as to size and capacity—is very large. In one prominent line of pneumatic arbor presses, used in some instances for oil grooving, there are 57 standard types in capacities from 600 to 50,000 lbs.

Mr. Hyler **has been previously introduced to our readers, his article on "Automatic Multiple Dip Pickling," December *The Tool Engineer*, having aroused considerable interest. In this article, he discusses various methods for oil grooving suitable for occasional or mass production jobs in large as well as small plants.**

In some instances, oil grooving is done with a portable power hammer, equipped with the proper type of tool. One manufacturer of pneumatic hammers has cited tools that are particularly good for such service, but then, most leading electric and pneumatic hammer manufacturers have models suited for the purpose. The method lends itself for grooving single pieces, of large unwieldy work, that are very difficult to handle by other means.

In plants having sufficient oil grooving, on standard parts, to justify installation of a standard oil grooving machine, this would be the preferred method, especially where the grooves are of helical type and where they cannot be put into the work with some other machine to still greater advantage. Oddly enough, such isolated cases do arise. Oil grooving machines designed especially for use on bearings, are often designed to hold the work in a revolving chuck secured on a work spindle. Since bearings can usually be rotated in perfect running balance, this method is highly advantageous.

Any Type of Groove May Be Cut

After the bearing is mounted in the revolving chuck, a boring tool is used to cut the groove. The boring tool is fastened to a carriage slide, given a reciprocating motion that is exactly timed with the work spindle on which the chuck is mounted, and linked by a crank gear and connecting rod. A number of attachments can be furnished with a machine of this general type, making possible to cut almost any type of oil groove. Some of these machines have a maximum capacity for work of 5" diameter, while others are larger, to handle work up to 15" diameter.

Where workpieces of relatively small size are to be oil grooved, the type of equipment used will depend considerably on lot sizes. One machine, in use in various plants, is particularly adaptable for short runs, being so designed that changeover from one kind of work to another is quite rapid. An added advantage is that work is loaded and unloaded, without stopping the machine; because of this, the unit is often referred to as a *continuous* oil groover. This type of machine is extensively used on such work as shafts, retaining rings, universal joints, connecting rods and similiar and, in many instances, handles up to 500 pieces per hour. Work is grooved either externally or internally. The design is such that when the grooving tool has reached its proper depth, a feed lever automatically returns it to the starting position.

Where workpieces are of fairly large size, and are odd, irregular or unusual in shape, the proposition of revolving them in a chuck for oil grooving is not feasible because of the balancing factor. However, they can be and are held in a *non*-revolving chuck, in such manner that a grooving tool, which both revolves and reciprocates, can be advanced for cutting the grooves. Machines with large capacity, non-revolving chucks have been built for such work, and are of special value to makers of locomotives and other heavy machinery. Further, the standard chuck can be removed from such a machine, when various types of special shape-holding fixtures may be substituted as the need may appear. With a machine of this type, practically any heavy or cumbersome workpiece may be oil grooved on a real production basis.

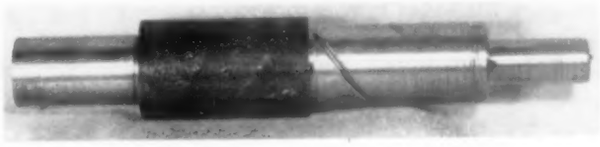


FIG. 1. The shaft as made and oil grooved on an 8-spindle automatic screw machine.

It should be observed that, on machines of this kind, the rotating motion on the tool is independent from the reciprocating motion, and that both phases of the combined motion are variable by means of change gears. Through varying the relative speeds of rotation and reciprocation on the tool, oil grooves of any desired lead or pitch may be produced on different diameters of work. The feed or depth of the cut is automatic. The machine is so designed that it can be pre-set for any amount of stock to be removed per cut, or it can be changed while in motion, if desired. The crank for reciprocating the tool head is also adjustable without stopping the machine. By adjusting the throw of the crank, the length of the oil groove is varied and brought to the exact value desired.

FIG. 2. The groove roll or die used on the special attachment in the fifth position on the screw machine, for rolling the oil grooves in the workpiece shown.

So-called "relieved" oil groove cuts are produced with a cam arrangement in the bottom of the machine. The contour of the cam can be designed to pull the tool away from the cut, to allow for making a groove half-way, quarter-way, or any other predetermined proportion of the distance around the circumference being cut. Also, by disengaging a clutch, the rotary motion of the tool can be dispensed with, if and when it is desired to cut straight grooves. Perfect keyways can also be produced, when desired, in much the same manner.

Occasionally, interesting instances come to light, as when some special machine, designed for some particular work other than oil grooving, has been fitted and tooled for a special oil grooving job. A case in point is that of a special gear burring machine, designed and built by a leading manufacturer of special machines, which carries two small fly cutters, held in separate spindles. In the gear burring operation, they are rotated at high speed, and also in synchronized relationship to the gear being chamfered. This is a rather remarkable machine, but space limitation forbids further elaboration here. Sufficient to say that, in some cases, it has been adapted for oil grooving and, in at least one instance, two rows of 20 oil grooves each have been cut simultaneously and in one setting. This, it may be safely said, is a very remarkable performance.

Oil grooving on a multiple spindle automatic screw machine is an idea probably new to most of us, yet, it is an operation which, in recent years, has been performed with excellent results. This is of still greater significance, from a production standpoint, when it is considered that the oil grooving (which in this case is external grooving on a shaft) is done in the same operation cycle in which the parts are produced, and that it is done without interfering with the overall efficiency of the unit. In this instance, the oil grooves are rolled in the shaft, with a special groove roll attachment. It does not require as much pressure for a job of this kind as one might suppose, considering that only a very small portion of the die is in contact with the shaft at any given instant. This is because both the die and the workpiece are roughly cylindrical in form. The rolling of the helical grooves is progressive, all of the pressure being localized practically at one point, all of the time.

An illustration of this part is shown, with the helical groove rolled in. There is also included a picture of the die which rolls the groove. Note that there are two helical grooves rolled into the part, while there are four helical groove-rolling members on the die. The diameter of the die or roll is twice that of the shaft and, in operation, the shaft on which the groove roll is mounted is rotated at exactly one-half the r.p.m. of the workpiece.

This job is done on a 2¼", 8-spindle Conomatic, and the oil grooving is one of a large number of machining operations, all of which are performed in 41 seconds, full production time on each part being 44 seconds. The material is fed in low, at the first or bottom position of the machine. Referring to the tooling layout shown, it can be seen that a forming tool is used in the second position which is wide and toothed, so as to relieve the work left to the third and fourth position forming tools. These forming tools in the third and fourth positions produce two diameters to required specifications, just before the groove rolling attachment comes into operation in the fifth or top position.

A fifth-position slide is available on these 8-spindle machines, placed in the top bed, for downward actuation. Actuation is through a cam roll on the slide, bearing against a cam on the camshaft. A bracket is screwed to this cam-actuated slide, and serves as a holder for the groove roll or rotary die. The rotary drive for the die is from the gear box at the end of the screw machine, through a splined and universally-jointed shaft, that readily follows the cam-actuated vertical motion of the groove roll.

Rolling an oil groove into these workpieces in this manner not only saves time as against oil grooving in a separate operation, but it also affords opportunity to roll a small radius on the shoulders of the grooves, thus eliminating possible cutting action of the sharp shoulder (which sometimes occurs with cut oil grooves) on a bushing or bearing in which this portion of the shaft later rotates. The impres-

All illustrations by courtesy of Cone Automatic Machine Co., Windsor, Vt.

FIG. 3. The gear train in the screw machine gear box which provides the rotary drive to the groove roll shown and described. A train of gears drives the splined and universally-jointed shaft on which the groove roll is mounted.

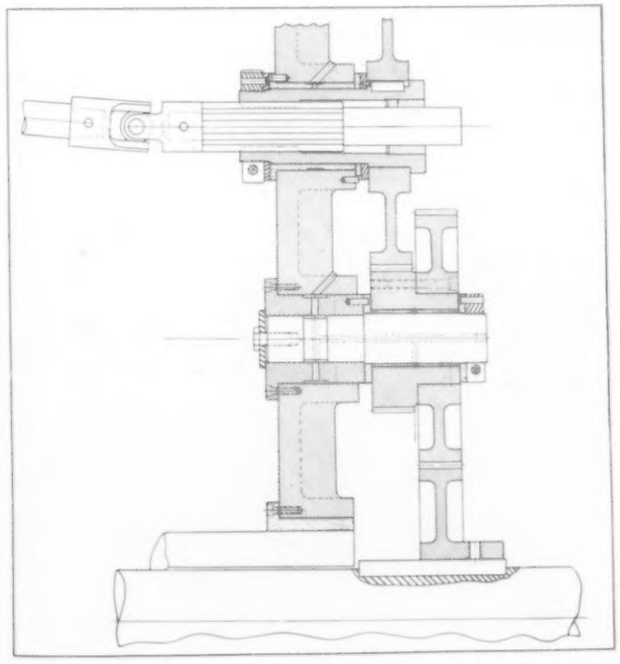
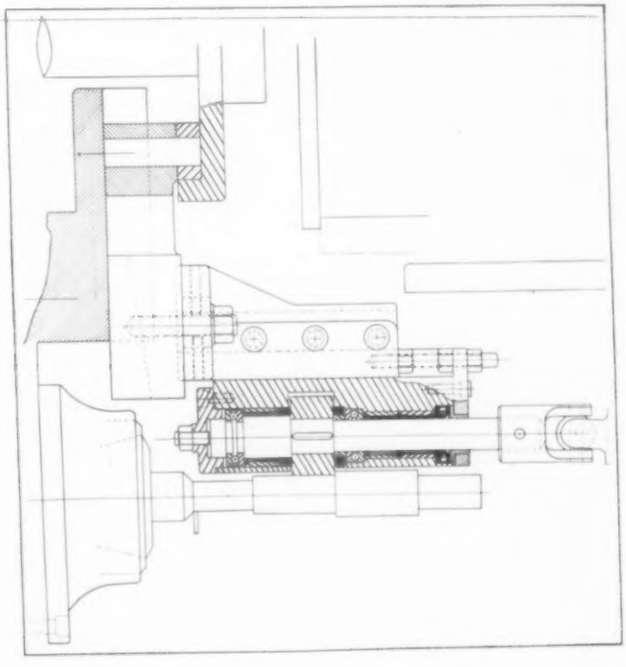
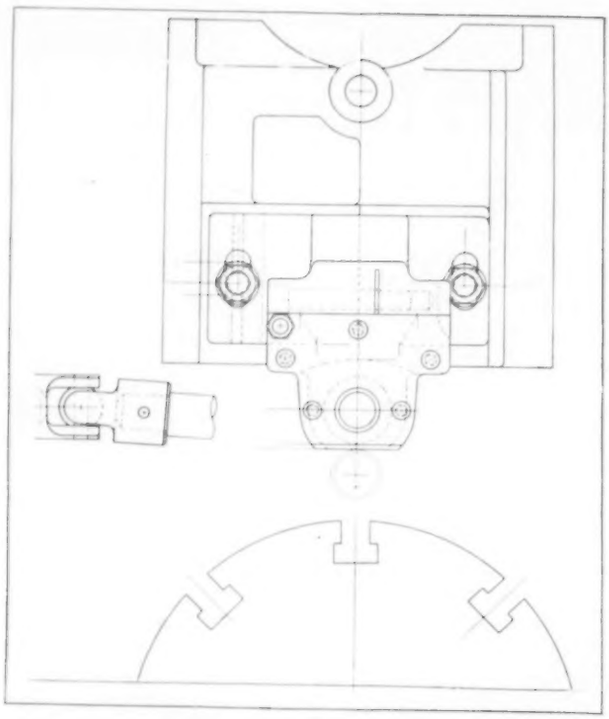


FIG. 4. Showing the groove roll attachment from the front.





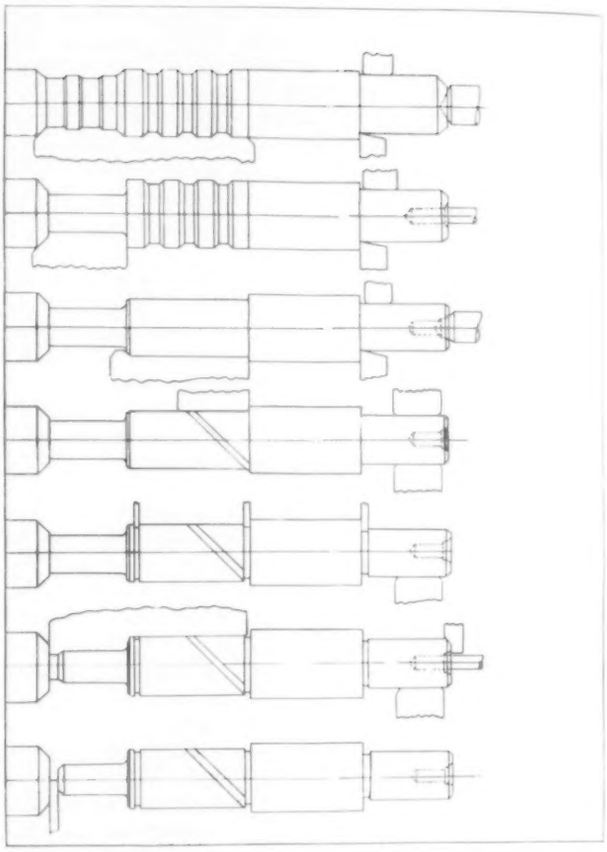


FIG. 5. Groove roll attachment, viewed from the side, as applied to 8-spindle screw machine for operation in the fifth or top position.
FIG. 6. Tooling layout for machining of the oil-grooved shaft, Fig. 1.

sion of the groove produced in the fifth position, as shown, is sufficiently deep to allow enough stock for the forming tool shown in the seventh position to clean up the burrs and still leave stock for the grinding operation to which these parts are later routed.

Manufacturers of the tools mentioned, on oil grooving, are as follows: Arbor presses, 57 standard types in capacities from 600 to 50,000 pounds, Hannifin Mfg. Co., Chicago; pneumatic hammers, especially good for oil grooving operations, Ingersoll-Rand, New York City; standard oil grooving machines having revolving chucks, Fisher Machine Co., Philadelphia. "Continuous" oil grooving machines and large capacity oil grooving machines with non-revolving chucks, on which the standard chuck can be replaced with various types of shape-holding fixtures, Wicaco Machine Corp'n, Philadelphia. The special gear chamfering machine, provided with two fly cutters ordinarily used but which has been adapted for oil grooving jobs, is by Cross Gear and Machine Co., Detroit. The multiple spindle screw machine, with oil grooving attachment, is a product of the Cone Automatic Machine Co., Windsor, Vt.

Awards for Achievement

1946 recipients of the Franklin Medal include Dr. Henry Clapp Sherman, Mitchell Professor of Chemistry at Columbia University, and Sir Henry Thomas Tizard, President of Magdalen College, Oxford University. The awards are announced by Dr. Henry Butler Allen, Secretary and Curator of the Franklin Institute, Philadelphia, and presentations were made April 17 by Charles S. Redding, President of the Institute, who coincidentally awarded a Certificate of Merit to Mr. Ronald D. Dodge, engineer with International Business Machines Corp'n, Poughkeepsie, N. Y.

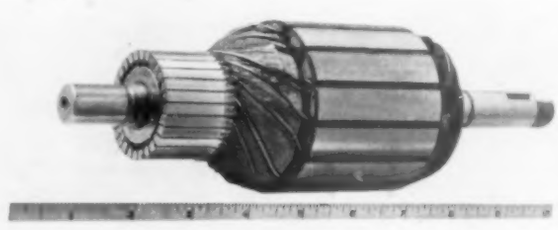
Dr. Sherman's award is in consideration of his many contributions to the science of nutrition; Sir Henry's "in recognition of outstanding contributions to the science of aeronautics," and Mr. Dodge's in "recognition for skill in design of the Proportional Spacing Machine" and developments in the electric typewriter.

Dr. Sanford A. Moss, Lynn, Mass., consulting engineer, General Electric Co., also was honored when he received the Howard N. Potts Gold Medal of The Franklin Institute. Dr. Moss received the award "in consideration of the extreme value of his work in making a turbosupercharger a successful and reliable part of an internal combustion engine."

Finishing Rotors by Shaving

Originally designed to finish cylindrical, conical and flanged surfaces with greater speed and economy than by turning or grinding, the "Red Ring" Roto Shaving process, developed by National Broach & Machine Company, has been put to a new and novel use—namely, finishing the O.D. of electric motor rotors.

The fine pitch cutters used with this method has no tendency to close the rotor laminations, as is the case with turning and grinding; consequently, there is no need to reopen them as a subsequent operation. Furthermore, shaving is said to be quite as accurate as the conventional method, leaves a comparable finish and is much faster.



By O. W. Boston

Research in Tool Engineering*

**Resume of a paper, by the author, at the recent A.S.T.E. New Era Exposition, Cleveland, Ohio.*

Subjects of Interest, to Tool Engineers, Are Being Constantly Improved and Expanded as a Result of Practice and Research.

To discuss research in tool engineering, one must first have an understanding of the limitations of tool engineering itself. Past President Otto W. Winter has defined tool engineering as "the art and science of analyzing, planning, designing, constructing, and applying the means and equipment for the mechanical production and manufacturing of industrial and consumer goods and commodities." This obviously includes a very wide field of activities on the part of the tool engineer, whose background of education and experience determines to what degree he is or can be regarded as a tool engineer.

Orlan W. Boston **was graduated from the University of Michigan, College of Eng'g (of which he is now Professor of Metal Processing and Dep't Ch'man) with degrees B.S., M.A. and M.E. Prominent in research—as on cutting oils and metal processing —he is author of some 150 papers, and a number of books, on these subjects.**

He is a fellow of the A.S.M.E., S.P.E.E., A.S.M., the Army Ordnance Ass'n and the Eng'g Soc'y of Detroit, and of the A.S.T.E. (Detroit Chapter), in which he is currently Ch'man of the Mss. Review Com'tee, Handbook, and of the Sub-Committee on College Education.

In the writer's opinion, tool engineering includes the analyses, planning, design, construction and application of any one or all of the following, whether they be used for toolroom, job shop, semi-production or mass production work: 1. Cutting tools, tool-holders and cutting fluids. 2. Machine tools, particularly those of special types. 3. Jigs and fixtures for machining. 4. Gages and measuring instruments. 5. Dies for sheet metal. 6. Dies for forging, upsetting, cold finishing, extrusion. 7. Dies for molding, die castings. 8. Patterns for permanent molds. 9. Fixtures and accessories for welding, riveting and assembling. 10. Abrasives, grinding compounds and fixtures for grinding, honing and finishing.

A tool engineer is probably interested in only one or, at the most, a few of these items as, in high quantity manufacturing, specialists are required. Each one of these subjects is being improved and expanded constantly as a result of practice and research. The following sections of this paper will outline briefly specific items of research and show how they may be of service to the Tool Engineer.

Cutting Forces and Power Requirement for Machine Tools

Forces developed by the cutter of a machine tool and the power requirements of the motor in metal cutting operations are of importance for several reasons:

1. The selection of the proper size of motor to be employed on the machine tool; 2. The design of the power transmission from the motor to the cutting tool; 3. The design of the feed transmission mechanism; 4. The determination of stresses and deflections in the frame and various parts of the machine tool; 5. The purpose of design of jigs, fixtures, and special tools for holding the work during the machining operation; 6. The selection of the proper size of cutting tools.

Power requirements have been obtained for various types of metal cutting operations such as turning, drilling, milling, planing, etc., and general conclusions may be drawn that the horsepower at the cutter divided by the cubic inches of metal cut per minute, called net horsepower per cubic inch per minute, has a value of approximately 1.0 for steel, and about 0.60 for cast iron. The gross horsepower per cubic inch of metal cut per minute, that is, the power developed by the motor, will average about 2.5 for steel and 1.2 for cast iron, based on an over-all motor and machine tool efficiency of from 40 to 50 per cent.

FIG. 1. A planer dynamometer for measuring the cutting force in the direction of cut.

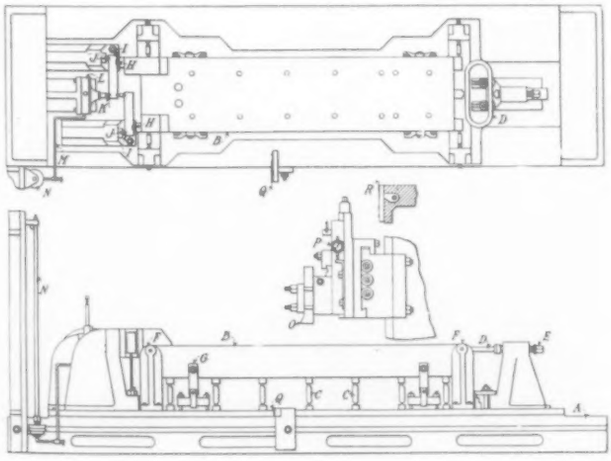
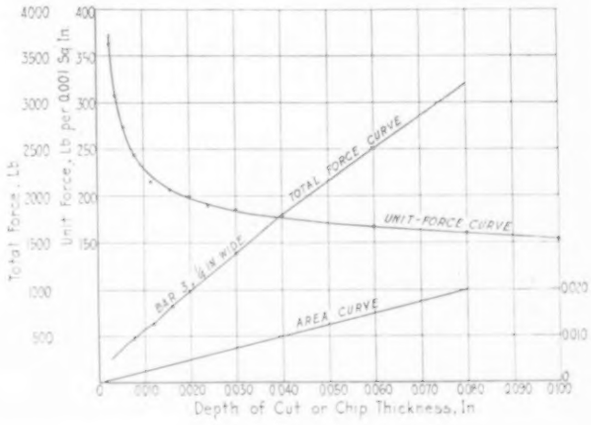


FIG. 2. The total cutting-force and unit-force curves when planing a land 1" wide on a steel forging of 0.15% carbon steel with an end cutting tool having 30° back rake and a 4° relief angle. The speed was 20 fpm and the depth of cut per pass was varied.



Planing with Dynamometer

A drawing of a dynamometer used on a planer to determine the influence of tool angles and size and shape of cut when cutting a wide variety of metals is shown in Fig. 1. To indicate the great influence of only one variable, *feed*, Fig. 2 is shown. The top of a land $\frac{1}{4}$" wide was removed by an end cutting tool at each stroke for each of a number of vertical feeds.

The base of the figure represents values of depth of cut or vertical feed. The area of the cut equals the variable depth times the constant width and is represented by the straight area line. The total cutting force F for the several depths is represented by a second curve.

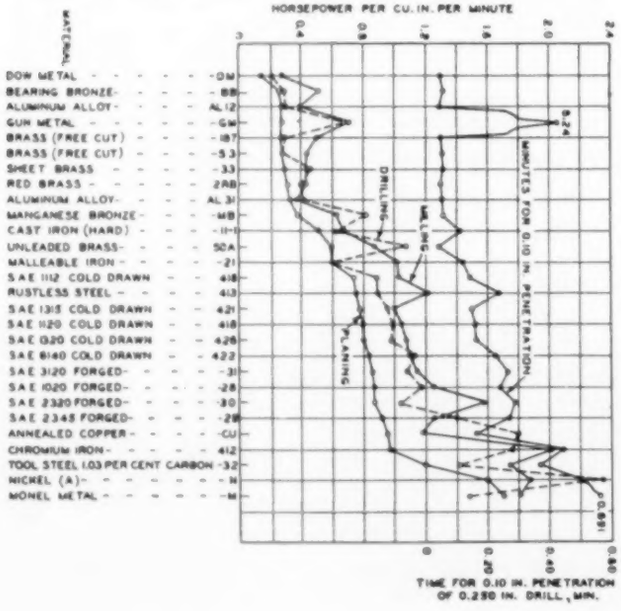
Dividing the force F by the area A gives the unit force, p, also represented by a curve having the greatest value for the thinnest chip. When the chip is 0.003" thick, the unit force is about 370,000 psi. When the thickness is 0.010", the unit force is 230,000 psi. When the thickness of chip is 0.024", the unit force is only 190,000 psi. For a further increase in depth of cut, the unit force would remain practically constant. This shows that thick chips are removed more efficiently from a force, or power, point of view, than thin chips, and for very thin chips the unit forces are very high. The equation for the total force F curve is F equals 81,300 wf 0.77 in which w is the width of cut and f the feed per stroke.

The force F times the cutting speed V divided by 33,000 gives the net horsepower at the cutter, Hp_c. For the depth of cut of 0.010" F equals 575 lbs. then Hp_c/cu. in. per min. is 0.35/.6 or .6. For a depth of cut 0.003", the Hp_c = = 285 × 20/33000 = 0.173. The Hp_c/cu. in. per min. equals .173/.18 or .96.

For chips of 0.001" thick the unit power will rise to 5 and for still thinner chips as in sawing and grinding it may go to 20 or 25.

These values will also be higher for lower rake angles of the cutting tool and will vary with the process and the material as shown in Fig. 3, which presents values of net horsepower per cubic inch per minute for drilling, milling and planing under specific conditions, as outlined in the legend of the figure, for a wide range of metals. For magnesium (Dowmetal), the horsepower per cubic inch of metal planed per minute is 0.12. The value increases through a wide variety of nonferrous metals up to about 0.6 for cast iron and malleable cast iron, and then ranges from 0.75 to 0.92 for a wide range of steels, is just below 1.0 for annealed copper, but increases to a maximum value of 1.7 for Monel metal. Similar values are given for specific conditions of drilling and milling on the same chart. These values, however, are uniformly higher than those for planing, as might be expected.

FIG. 3. Net values of horsepower per cubic inch of metal removed per minute for a variety of metals as determined for planing, milling and drilling. The drill used was $\frac{3}{4}$" dia., had a 30° helix, and was operated at 153 rpm and 0.012" ipr feed. The planing tool was of the end-cutting type $\frac{1}{2}$" wide, having 15° back rake, no side rake and operated at 20 fpm with depth of cut per stroke of 0.010". The milling cutter was of the end-cutting type of 0.25" wide, 3.5" dia., having 15° radial rake, no axial rake. Took a cut 0.125" deep, with feed of 0.010" per tooth. The penetrator drill indicating machinability was $\frac{1}{4}$" dia., had a helix of 24°, and operated under a feed load of 94 lb. at 500 rpm.



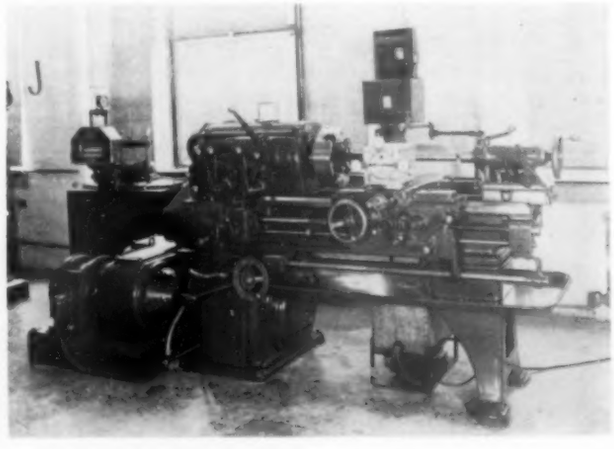
Turning with Dynamometer

An engine lathe with a 3-component force dynamometer used in determining cutting forces in turning is illustrated in Fig. 4. The three components of the cutting force, namely, the tangential, F_T, the longitudinal, F_L, and the radial, F_R, are determined for each of several cuts as the feed and depth of cut are varied for a given material and tool shape. For one feed, values of force are determined for each of several depths of cut as shown on log-log paper at the left in Fig. 5. Again, the depth may be kept constant and the forces for each of several feeds may be determined as shown on the right in Fig. 5. Usually the force line for one constant feed is parallel to all other lines in which the feed is constant. Therefore, in determining such force relationships, it is necessary to use only one constant feed and vary the depth to get one line on log-log paper. A second line is obtained for a constant depth and variable feed, as shown on the right. The slope of these lines represents the exponent of the variable so that for the tangential component of the cutting force F_T, as shown in the upper part of Fig. 5, the exponent of d is 1. The exponent of f is 0.83. The equation then for F_T as a function of f and d is $F_T = Cf^{0.83}d^1$. By substituting the force for any given feed and depth in the formula, the value of the constant is obtained. For the conditions outlined in Fig. 6, the equations are:

tangential force, $F_T = 133{,}000\, f^{0.83}d$
longitudinal force, $F_L = 33{,}7000\, f^{0.48}d^{1.45}$
radial force, $F_R = 923\, f^{0.56}$

From these equations, values of forces can be computed for any combination of depth and feed.

FIG. 4. An engine lathe driven by a variable speed mechanical device for obtaining any specific surface cutting speed. A three-component dynamometer is mounted on the compound-rest circle, and a cutting fluid tank which maintains the cutting fluid at a constant temperature is shown below.



Cutting force equations and values of the force for a given cut is SAE 3135 steel are shown in Table I. To obtain the power developed by the motor, the net power as determined from these forces must be divided by the efficiency of the machine and motor. The net power developed by the radial component of the cutting force is zero inasmuch as no speed is involved. The net power developed by the longitudinal force amounts up to 5 per cent of the total power and is determined by multiplying the longitudinal force by the feed in feet per revolution, times the revolutions of the work per minute, and divided by 33,000, or $F_L fn/12 \times 33{,}000$. The net power developed by the tangential force component is $F_T V/33{,}000$.

TABLE 1—CUTTING FORCES AND FORCE EQUATIONS[a]

	Tool No. 1	Tool No. 2
Tool signature	8-14-6-6-6-15-3/64	8-22-6-6-6-15-3/64
Tangential force	$259000\ f^{0.98}d^{1.0}$	$174000\ f^{0.90}d^{1.0}$
	1250 lb.	1110 lb.
Longitudinal force	$35700\ f^{0.39}d^{1.55}$	$950\ d^{1.08}$
	480 lb.	123 lb.
Radial force	$7300\ f^{0.74}d^{0.28}$	$25700\ f^{0.84}d^{0.58}$
	320 lb.	450 lb.

[a] When turning an annealed S.A.E. 3135 steel dry at 50 fpm with $\frac{3}{8}$-in. square high-speed-steel tool bits. Force values listed are for a depth of cut of 0.150 in. and a feed of 0.030 in.

Turning with Wattmeter

The recording wattmeter is very useful in studying various features of tool engineering. It may be moved from one machine to another conveniently and records the gross and net power developed by a motor.

In a series of turning tests on a lathe, the net horsepower at the tool point was obtained by subtracting the tare power in kilowatts from the gross as recorded on a wattmeter. The gross power was obtained with a lathe under full cut. The tare was obtained with the lathe operating with all gears engaged but not cutting. Representative values are shown in Table II. In the first test, a tool of high-speed steel had a shape of (8,22,6,6,6,15,3/64) 8° back rake, 22° side rake, 6° side relief, 6° end relief, 6° end-cutting-edge angle, 15° side-cutting-edge angle, and 3/64" nose radius. The feed f was 0.010 ipr, the depth of cut d was 0.050", and the cutting speed V was 150 fpm. The tool life T was 18.02 min. The cubic inches of metal cut per minute was 0.9 and equals $f \times d \times 12V$. The gross power was 1.70 kw., the tare was 1.10 kw., giving a net power at the tool point of 0.60 kw. The 0.60 kw. divided by 0.746 gives 0.81 net horsepower at the tool point. This divided by the cubic inches of metal removed per minute gives the net horsepower per cubic inch per minute of 0.9 which agrees fairly well with the values for the similar steels SAE 2320 and SAE 2345 in Fig. 6. The net horsepower is equal to the tangential cutting force F_T times the cutting speed V divided by 33,000. From this, F_T is found to be 179 lb.

In the second cut where a side rake angle of 14° was used instead of 22 in the first cut, and a cutting speed of 55 instead of 150 fpm, the net horsepower is found to be 0.40. The net horsepower per cubic inch per minute is 1.21, and the tangential force is 250 lb. Additional tests were run with Carboloy tools, ground to a characteristic shape of 0° back rake and 8° side rake, operating with various values of feed and depth of cut. The net horsepower per cubic inch of metal cut per minute is shown to be 1.04 for the feed of 0.010". It is 0.87 cu. in. for a feed of 0.030". In general, it is seen that these values are high for light feeds, and low for heavy feeds or for large depths.

Lathe Efficiency

The relation between output and input power may represent the efficiency of the machine tool. This total over-all efficiency is a function both of the motor and of the mechanical efficiency of the machine. In test 1, Table I, it is 0.81/2.28 or 35.5 per cent. The gross horsepower per cubic inch cut per minute would be $0.9/0.355 = 2.54$.

The efficiency of this 16-speed geared-head lathe when developing 2 hp at the spindle was found to range from 45 per cent for the lowest speed of 18 rpm down to 37 per cent for a speed of 105 rpm, and only 26 per cent for the highest speed of 750 rpm. This would indicate that only about one-third of the power developed by the motor is delivered at the spindle. When one horsepower was devel-

TABLE 2—TOOL LIFE AND POWER TESTS TURNING SAE 3140 STEEL NORMALIZED AND ANNEALED (220 B)

Test No.	Tools	f in.	d in.	V f.p.m.	T min.	Vol. cu. in. per min.	Kw.	Hp. gross	Hp. tare	Hp. net	Net Hp. cu. in. min.	Tang. Force "F" lbs.
1	H. S. S. 8, 22, 6, 6, 6, 15, 3/64	.010	.050	150	18.02	.9	1.70g 1.10t	2.28	1.47	.81	.9	179
2	C. T. S. 8, 14, 6, 6, 6, 15, 3/64	.010	.050	55	2.4	.33	1.35 1.05	1.81	1.41	.40	1.21	250
3	Carboloy 78B 0, 8, 7, 7, 8, 0, 1/32	.010	.050	1000		6.0	7.9 3.25	10.60	4.35	6.25	1.04	206
4	Carboloy 78B 0, 8, 7, 7, 8, 0, 1/32	.015	.050	300		2.25	2.85 1.2	3.82	1.61	2.21	1.03	243
5	Carboloy 78B 0, 8, 7, 7, 8, 0, 1/32	.030	.050	300		4.50	4.12 1.2	5.52	1.61	3.91	.87	430
6	Carboloy 78B 0, 9, 8, 8, 9, 0, 1/32	.060	.050	300		9.0	7.0 1.2	9.37	1.61	7.76	.86	855
7	Carboloy 78B 0, 8, 7, 7, 8, 0, 1/32	.010	.250	300		9.0	6.85 1.2	9.10	1.61	7.39	.82	812
8	Carboloy 78B 0, 8, 7, 7, 8, 0, 1/32	.015		290		13.0	9.75 1.2	13.0	1.61	11.39	.875	1300

oped at the spindle, the average efficiency of the lathe was 25 per cent; for 3 hp it was 50 per cent.

Tool Life of Tools when Turning a Steel with Different Heat Treatments

The relation between cutting speed and tool life of all cutting tools operating under constant cutting conditions is such that the life increases as the speed is reduced. For all processes of cutting such as turning, milling, drilling, etc., the relationship is found to be $VT^n = C$ in which V is the cutting speed in fpm, T is the tool life in minutes, C is a constant and equals the cutting speed for a tool life of one minute, and n (the exponent of T), is the slope from the horizontal, of the line on log-log paper as shown for the lowest line in Fig. 7. Each of these lines is obtained by cutting at one speed and recording the tool life, then at a second speed and recording that tool life. These points plotted on log-log paper indicate a straight line, several instances are shown in Fig. 7. The most satisfactory line is the one which is highest and with the least slope from the horizontal.

The hardness of steel reduces the cutting speed for a given tool life almost directly as the hardness is increased as shown in Fig. 7. Thus the cutting speed for a 50-minute tool life of the mill annealed 4340 steel, when being machined with a feed of 0.0127" and depth of cut of 0.050", is about 136 fpm. For the same steel quenched and drawn to give a Brinell hardness of 492, the cutting speed for a 50-minute tool life is only 28 fpm. The Brinell hardness increase is 1 to 2.5 while the cutting speed is reduced about 5 to 1.

The cutting speed for any value of tool life for each of several values of hardness can be determined from the Chart Fig. 7. In general, the cutting speed varies a great deal with the hardness of the steel, and steels of different analyses, particularly of the alloy steel types, will produce slightly different cutting speeds for the same hardness, and yet it has been found that different heats of the same analysis may produce greater variations in cutting speed for the same tool life than steels of different analyses.

While cutting forces do not change appreciably as the speed is changed, more motor power is required when operating at higher speeds.

Fig. 8 shows $VT^n = C$ curves on log-log paper for several values of side rake angle. The highest line is for the 22° rake angle. The ones for 30° and 14° are lower, showing 22° to be best for this condition.

Developments in Making and Applying Cutting Tools

Many improvements in the analyses, heat treatment, surface treatments, and finishing of tools have been made during the past few years. Much has been learned by the metallurgist of the tempering of high speed steels, the transformations taking place and the temperatures at which they occur. Multiple tempering is found advantageous with this better understanding.

Sub-zero or deep-freeze treatment of all high-speed steels has been the object of a great deal of experimentation during the past 2 or 3 years. This treatment is involved and may call for the cooling of the steel to 100 to 120°F below zero before single or double tempering, between temperings, or after single or multiple tempering to complete the transformation of austentite to martensite. Many experiences

FIG. 5. Tangential and longitudinal cutting forces for various depths and feeds when turning, dry, a 0.21% carbon steel log with a H.S.S. tool having 8° back rake, 14° side rake, 6° end and side relief, 6° end cutting edge angle, 0° side cutting edge angle and a nose radius of 3/64".

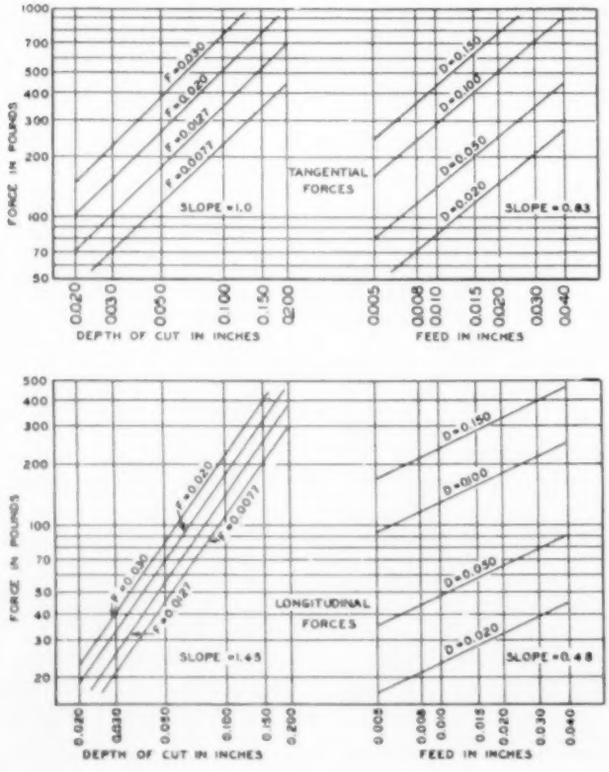
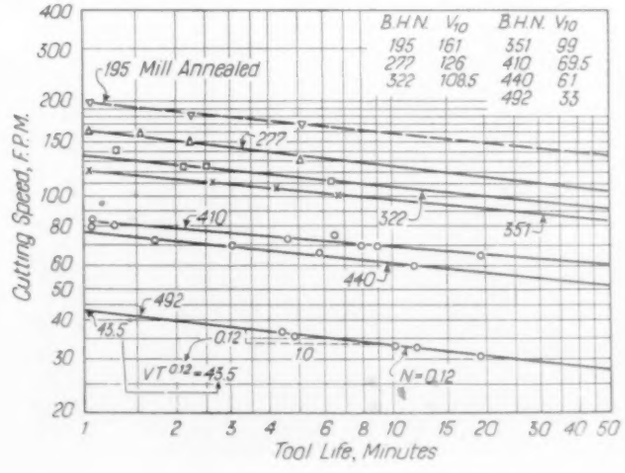


FIG. 6. A machine tool, cutter, fixture, and cutting fluid, all problems of the tool engineer, as applied to the slab milling of a heavy steel part. (Courtesy Cincinnati Milling Machine Co.)

FIG. 7. A log chart showing the relationship between cutting-speed and tool-life in minutes for a feed of 0.0127" and depth of cut of 0.050", when turning SAE 4340 steel heat treated to give various degrees of hardness. The cutting tools had 8° back rake, 14° side rake, 15° side cutting edge angle, and 3/64" nose radius. They were of 18-4-2 steel.



have shown real benefits in tool life resulting from this low temperature treatment, but my own experience has shown that tools properly heat treated show no improvements while some tools believed improperly treated have shown improvements.

Dr. G. A. Roberts recently stated that surface treatments improved the tool life of high-speed steels by (a) increasing surface hardness; (b) increasing wear resistance; (c) preventing seizure between chip and tool; (d) lowering the coefficient of friction, or (e) distributing the load more uniformly over the cutting edge.

These factors are somewhat interrelated. Nitriding produces a hard case .0005" to .003" thick which acts to increase the hardness and wear resistance of high-speed steel tools and lowers the seizure characteristics. This treatment seems to increase the performance of most tools used for relatively light cuts such as drills, taps, reamers. Carburizing or pack hardening increases the wear resistance and is extremely useful for certain classes of shearing or blanking dies. Both nitriding and carburizing may induce residual surface compressive stresses.

Chromium plating is used extensively as a means of conserving tool materials by building up to size. Normally by the Lundbye process only .0001" or less thickness of plate is obtained. The experience of the Warner & Swasey Co., for example, shows that it is economical to replate a cutter after each sharpening even though the cutter is ground only on the relieved surfaces and not on the tool faces. The benefits obtained are phenomenal—in many cases increasing the life of taps from 30 to 40 times, thread chasers from 12 to 22 times, broach guides 7 to 10 times, reamer 5 to 9 times, plug and ring gages 6 to 7 times, and various other types of cutting tools from 3 to 7 times.

Oxide coatings are effective in preventing seizure and lowering friction. This layer of black oxide of iron is very thin (0.0002" or less) and reduces friction between tool and chip. Our own experience shows it to wear off and thus soon become ineffective. Superfinishing and liquid honing may improve tool performance by eliminating edge roughness, distributing the load more uniformly over the cutting edge and preventing the breakdown of small portions of the cutting edge. This provides keen cutting edges.

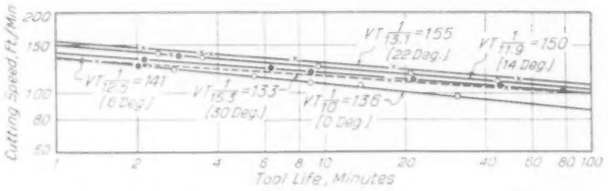


FIG. 8. Cutting-speed tool-life lines on log-log paper for several side-rake angles on high-speed-steel tools when turning annealed SAE 2335 steel with a feed of 0.0127" and a depth of cut of 0.10".

FIG. 9. A large lathe with infinitely variable-speed drive provided with a cutting fluid cooler to study different cutting fluids at a constant temperature or a given fluid at each of several temperatures.

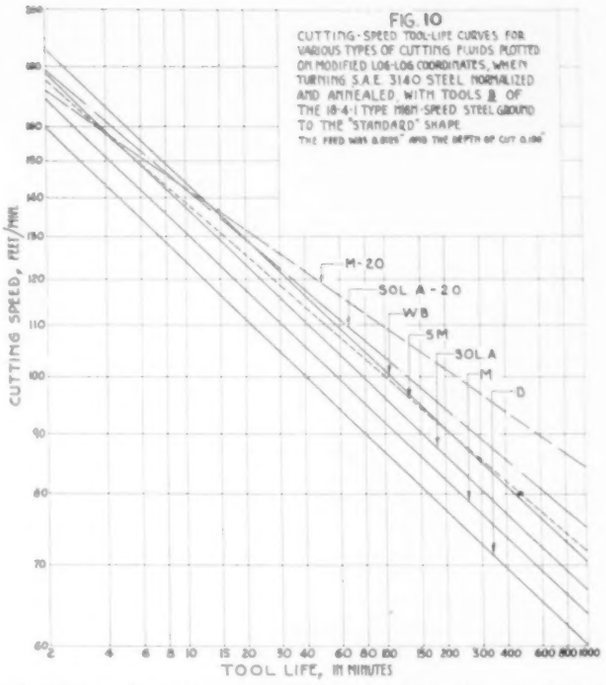


FIG. 11. A heavy-duty drill press with a hydraulic dynamometer for recording torque and thrust. The recording gage is shown on the left and the wattmeter on the right.

In addition to these treatments of high-speed steel to improve its performance, advances have also been made in other tool materials. New improved cast non-ferrous metals have been made available and improvements are constantly being made in the sintered-carbides. Current literature and speakers bring a great deal of this new information to us but many developments are announced with little or no detail so the tool engineer must determine their merits and best application in whatever way he has available.

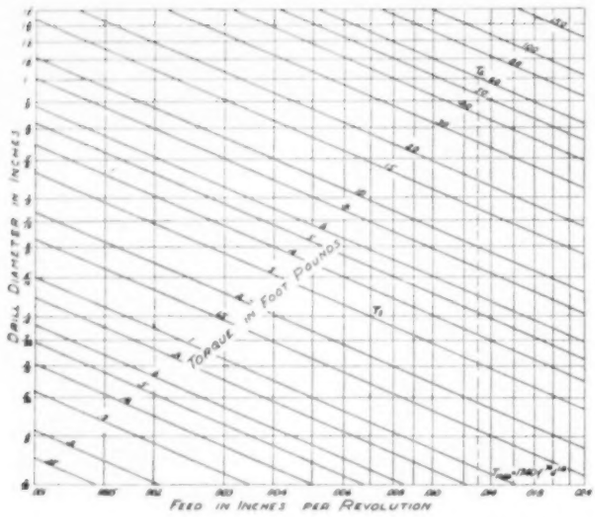


FIG. 12. A chart on log-log coordinates showing the relation between drill diameter, feed, and torque when drilling annealed SAE 1020 steel, with commercial high-speed 30° helix angle drills at 60 fpm and using a 1-to-16 emulsion. The web thickness is given in Fig. 13.

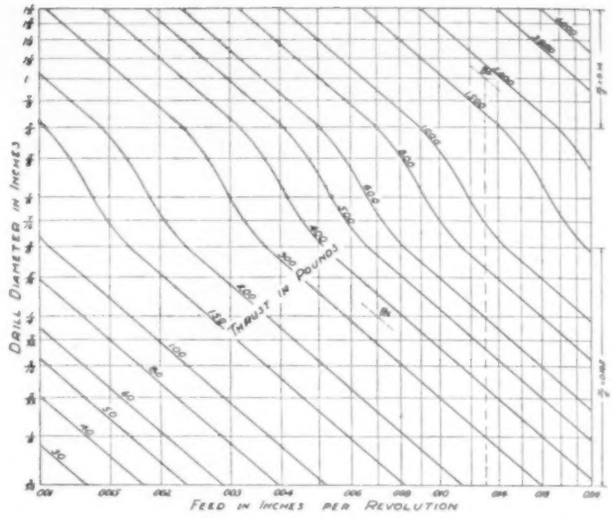


FIG. 13. A chart on log-log coordinates showing the relation between drill diameter, feed and *thrust* when drilling annealed SAE 1020 steel with commercial high-speed 30° helix drills at 60 fpm using a 1-to-16 emulsion. The ratio of web thickness to drill diameter was 0.185″ for drills up to ⅜″, but was 0.162″ for the ½″ drill and 0.14″ for the ¾″ and larger drills.

Application of Cutting Fluids

A large lathe, used primarily where the material cut is to remain constant and therefor permit the use of a large uniform test log, is shown in Fig. 9. Various types of cutting fluids applied under standardized conditions of quantity, and temperature, or a cutting fluid at each of several different temperatures, may be evaluated. This lathe may also be equipped with the all-metal or hydraulic 3-component dynamometer shown in Fig. 3 for force determinations. In one set of tests it was found that the most effective operating temperature of the sulphurized mineral cutting oil was at 70° to 75°F, whereas an emulsion was most effective in prolonging tool life at from 55° to 70°F. For those operations in which a great deal of heat is developed, the tool engineer should provide ample flow of cutting fluid on the tool and if necessary provide refrigeration to keep the cutting fluid at or not far above room temperature.

Fig. 10 shows the cutting-speed tool-life lines on modified log-log paper for several different types of cutting fluids when applied at 110°F at 5 gpm on the tool of high-speed steel turning annealed SAE 3140 steel. The cutting speed for a 20-minute tool life is 110 fpm for dry cutting D, 118 for mineral oil M, 123 for emulsion of Sol A, 126 for sulphurized mineral oil SM, and 129 for borax water WB.

A drill press used for studying drilling problems is shown in Fig. 11. This is provided with a wattmeter shown at the right for recording the gross, tare, and net power of the motor in operation and a dynamometer for measuring and recording the torque and thrust at the drill point.

FIG. 14. A No. 4 plain milling machine equipped with a three-component dynamometer and a recording wattmeter.

Drilling with Dynamometer and Wattmeter

A complete set of these data are shown in Table III from tests in drilling an annealed SAE 6150 steel, Brinell 187, and a soft cast iron, Brinell 163, with drills from ½″ to 1½″ diameter. Each drill was operated at 60 fpm and at its proper feed.

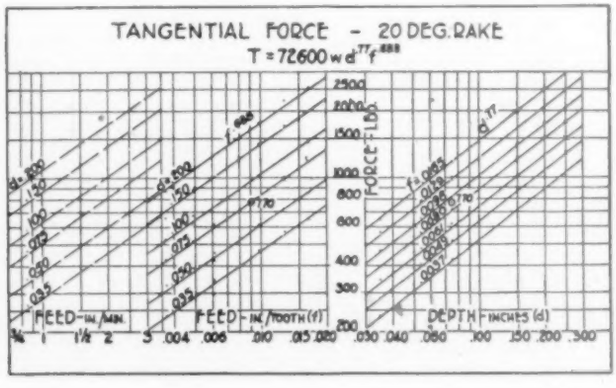
To make it possible to determine the torque T, thrust B, or power for any other combination of diameter and feed, the following equations were determined from experiments in which the drill diameter d and feed f were varied separately.

$$\text{For the steel,} \begin{cases} T_{6150} = 1{,}840\, f^{0.78} d^{1.8} \\ B_{6150} = 53{,}400\, f^{0.78} d \end{cases}$$

$$\text{For the cast iron,} \begin{cases} T_{CI} = 380\, f^{0.6} d^{2} \\ B_{CI} = 14{,}720\, f^{0.6} d \end{cases}$$

Values of torque for any drill diameter and feed may be obtained from the log-log graph, Fig. 12. The torque for a ¼″ drill operating at 0.007″ feed in the SAE 1020 steel is 3 lb-ft. at T_1, the intersection of the horizontal line through the ¼″ drill size and vertical line through the 0.007″ feed. T_2 represents 60 lb-ft., the torque developed by a 1″ drill operating at 0.013″ feed. The torque for other steels may be obtained by multiplying the value from Fig.

FIG. 15. Tangential forces plotted on log-log paper for the 20° rake, 25° left-hand helix slab mill 3″ in diameter, having 12 teeth, operating at 17 rpm (13.3 fpm) when cutting annealed SAE 3150 steel at various feeds and depths with a sulphurized mineral-lard oil, width of cut 2″.



12 by the following factors: 0.75 (90) for SAE 1035, 1.06 for annealed tool steel, 0.86 (1.15) for annealed SAE 3150, and 0.58 (0.69) for SAE 1112 steel. The first values are for drills below ½" diameter and those in parentheses for drills above ½" diameter.

Values of thrust in lbs. when drilling SAE 1020 steel with any drill diameter operating at any feed may be read from the log-log graph, Fig. 13. The drill had unthinned points and operated in an emulsion of 1 part soluble oil to 16 parts of water. For thrust in drilling other metals, multiply that for SAE 1020 steel by the following factors: 0.94 for SAE 1035, 1.2 for annealed tool steel, 1 for SAE 3150 and 0.74 for SAE 112 cold finished steel.

The total net horsepower developed at the drill point equals the horsepower due to the torque plus the horsepower due to the thrust as follows:

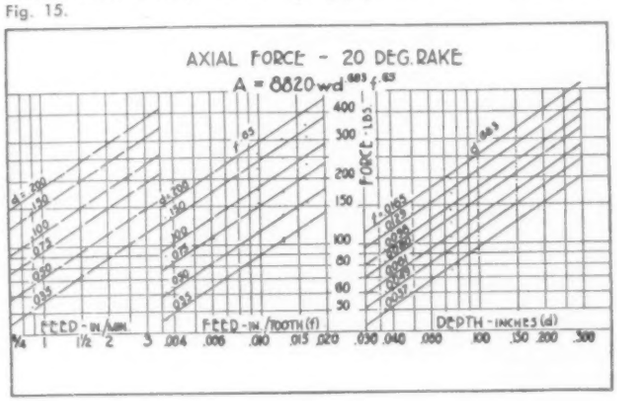
$$\text{Hp} = \frac{2\pi\ Tn}{33{,}000} + \frac{Bfn}{12 \times 33{,}000}$$

To illustrate, the 1¼" dia. drill with a feed of 0.015", rotating at 175.1 rpm (60 fpm) when cutting SAE 6150 steel, Table 3, has a torque of 110.8 lb-ft. and thrust of 2,430 lb. Substituting these values in the above equation would give the total horsepower as follows:

$$\text{Hp.} = \frac{2\pi \times 110.8 \times 175.1}{33{,}000} + \frac{2.430 \times 0.015 \times 175.1}{12 \times 33{,}000}$$

$$= 3.694 + 0.016 = 3.71$$

FIG. 16. Axial forces plotted on log-log paper for the cuts described in Fig. 15.



It is seen that the horsepower due to the thrust is only 0.016 or 0.44 per cent of the total power developed, so for power purposes the horsepower output due to the thrust may be neglected. It is of importance in design, however. Table 3 shows that the efficiency of the machine as determined by dividing the input by the output is highest when using small drills operating at high speed with resulting low values of torque and thrust. Similarly, the efficiency is lowest when the torque and thrust are high, even though the speed of the machine is less. It has been found that torque and thrust are affected but little by a change in cutting speed. The power, however, is a direct function of the speed, as illustrated above.

The horsepower per cubic inch of metal cut per minute is obtained by dividing the total power by the cubic inches of metal cut per minute V. These formulas for steel and cast iron become

$$(\text{Hp./}V)_{6150} = \frac{0.446}{d^{0.2} f^{0.22}}$$

and

$$(\text{Hp./}V)_{CI} = \frac{0.092}{f^{0.4}}$$

The net horsepower per cubic inch of metal cut per minute is lower for larger values of feed and drill diameter. In drilling SAE 6150 steel with a ½" dia. drill at 0.009" feed, a value of 1.443 is obtained. For drilling the same steel with a 1¼" dia. drill at 0.015" feed, the horsepower per cubic inch per minute is 1.075. For cast iron, these values are 0.605 and 0.493, respectively.

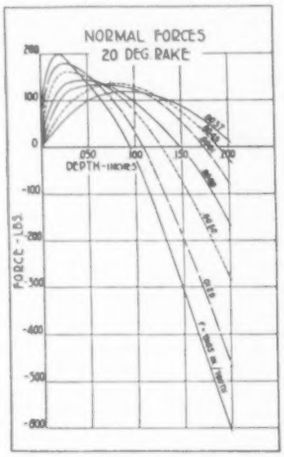


FIG. 17. Normal forces plotted on cartesian coordinates over the depth of cut in inches for the cuts described in Fig. 15.

Slab Milling with 3-Component Dynamometer and Wattmeter

With the milling machine and equipment shown in Fig. 14 the three components of the cutting force, tangential T, normal N, and axial A were obtained for various combinations of cut as shown in Figs. 15, 16, and 17. The normal

TABLE 3—TORQUE, THRUST, AND POWER IN DRILLING AN ANNEALED CHROME-VANADIUM STEEL, SAE 6150, AND A SOFT CAST IRON, USING AN EMULSION OF 1 PART SOLUBLE OIL TO 16 PARTS WATER*

Drill Dia. In. d	Actual R.P.M. N	Feed, In. per Rev. f	Torque, Lb.-Ft. T		Torque Horse-power, Hp T	Thrust, Lb. B		Thrust Horse-power, Hp B	Total Output, Hp.	Input, Kw. from Wattmeter			Net Input, Hp.	Efficiency Per Cent
			Test	Formula		Test	Formula			Gross	Tare	Net		
Test Results on Steel, SAE 6150 Steel														
½	444.5	0.009	14.0	13.43	1.185	725	678	0.00732	1.193	1.6	0.67	0.93	1.244	96
⅝	368.0	0.011	22.3	23.4	1.562	838	990	0.00856	1.571	2.025	0.67	1.355	1.815	87
¾	299.7	0.012	34.3	34.8	1.957	1,269	1,273	0.01153	1.975	2.42	0.67	1.75	2.34	84
1	228.1	0.013	62.4	62.4	2.71	1,862	1,820	0.01394	2.724	3.176	0.57	2.606	3.49	78
1¼	175.1	0.015	110.8	104.0	3.694	2,430	2,520	0.01611	3.710	3.87	0.57	3.3	4.42	84
1½	149.0	0.015	143.3	144.0	4.07	3,000	3,020	0.01693	4.087	4.507	0.507	4.0	5.35	76
Test Results on Cast Iron														
½	446.0	0.009	6.3	5.6	0.535	530	436	0.00614	0.541	1.12	0.67	0.45	0.602	90
⅝	364.4	0.011	10.2	9.9	0.708	645	615	0.00652	0.715	1.32	0.67	0.65	0.870	82
¾	299.7	0.012	15.7	15.05	0.896	803	778	0.00728	0.903	1.48	0.67	0.81	1.084	83
1	229.8	0.013	27.9	28.1	1.221	1,088	1,088	0.00822	1.23	1.72	0.50	1.22	1.635	75
1¼	179.4	0.015	46.4	47.8	1.585	1,403	1,481	0.00954	1.60	2.025	0.45	1.575	2.110	76
1½	153.4	0.015	65.9	68.7	1.925	1,700	1,778	0.00988	1.94	2.27	0.37	1.90	2.550	76

*Standard twist drills were used with 31-deg. helix angle, 121-deg. point angle, 136-deg. chisel-edge angle, and 5-deg. relief angle. The ratio of web thickness to diameter was 0.14 for the ¾ in. and larger drills, 0.162 for the ½-in-dia. drills, and 0.185 for drills up to ⅜ in. dia. Speed 60 f.p.m.

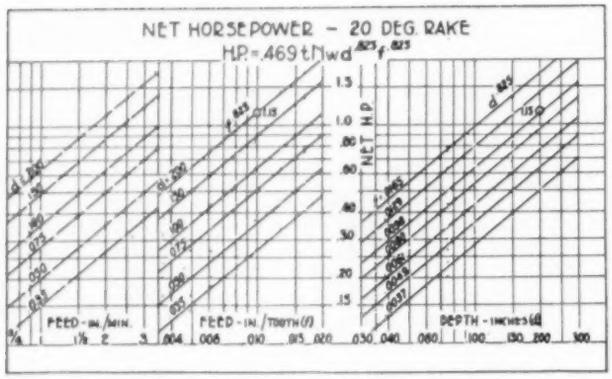


FIG. 18. Net horsepower as determined from the wattmeter for various feeds and depths plotted on log-log paper for the cuts described in Fig. 15.

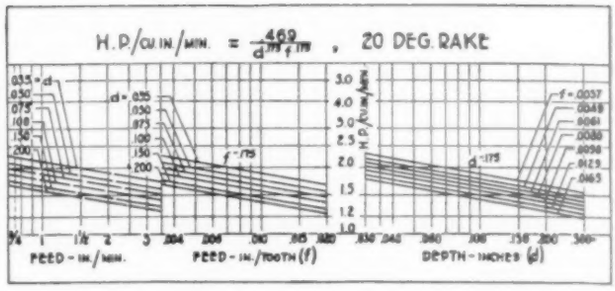


FIG. 19. Net horsepower per cubic inch per minute plotted over feed and depth for the cuts described in Fig. 15.

forces are first compressive as the depth is increased as shown in Fig. 17, but as the depth reaches certain values, the force is negative, tending to lift the work and fixture from the table. The net horsepower at the motor (gross minus tare) is shown for various depths of cut and feed per tooth in Fig. 18 and the unit net power at the motor per cubic inch of metal removed per minute is shown in Fig. 19. The lowest value is 1.2 for the heaviest cut of 0.5" depth and 0.0165" feed per tooth. The highest unit net power is 2.3 for the lightest cut.

During the past year much has been learned about the application of sintered-carbide face milling cutters when machining aluminum, steel, and cast iron. The speeds at which the carbide tool functions most satisfactorily and economically is better understood. The nature of the wear, Fig. 20, on the tools to the point of cutter regrinding has been studied scientifically. The use of flywheels on milling machines of less rigidity has given smoother cutting and prolonged cutter life through the reduction of the chipping of the cutting edge.

It has been found beneficial to maintain heavy feeds per tooth and relatively high speeds in carbide face milling even at the sacrifice of the number of teeth in the cutter in order not to overload the driving motor. The tooth shape has been studied and can be selected with better assurance of successful operation than previously. The influence of depth of cut and cutting speed are found to influence net power at the motor in direct proportion while the heavier feed per tooth is found to be more efficient for both steel and cast iron. The hp/cu.in. per min. is not affected by speed or depth of cut, but is lower for the heavy feeds as shown in Table IV.

Research in Grinding and Grinding Compounds

A special setup for making a study of the grinding process and the improvement of wheels and grinding compounds is shown in Fig. 21. A method of procedure for evaluating wheels for a given cutting fluid and material is shown in Table 5. The test conditions are first outlined and below the results of the tests are tabulated, when using two wheels —one an 80 grit and the second a 150 grit wheel. The volume ratio, Vr; of metal ground, Vm; to wheel wear, Vw; is shown to be 70.5 for the 80 grit wheel and 52.6 for the 150 grit wheel. The net horsepower is 2.80 and 1.85, respectively. The grinding characteristic, which equals the volume ratio, divided by the net horsepower, Vr/Hp_n, is 24.8 for the 80 grit wheel and 28.4 for the 150 grit wheel. The horsepower per cubic inch per minute is higher for the 80 grit wheel as is the percentage increase in horsepower per cubic inch per minute. The increase in temperature of the surface was 16° for the 80 grit wheel and only 12° for the 150 grit wheel. The surface finish, however, is approximately the same for the two conditions. This procedure is being developed for further work in studying wheels, materials ground, and grinding compounds.

A study, similar to this on grinding, was made of the honing process. It was found that the rate of metal removal and the resulting surface quality on both steel and cast iron could be greatly improved by a careful selection and balance of stone and honing compound.

Conclusions

The few preceding examples of laboratory experiments are intended to show how specific data useful to the tool engineer are determined. Many such experiments are carried out by industry, but only a small portion of the results are made available generally. However, the tool engineer must have much more information at his command.

In the design of jigs and fixtures, it is always a combined program to design for strength on the one hand with rigidity,

TABLE 4—UNIT POWER BASED ON NET POWER AT CUTTER as a Function of Feed per Tooth, Depth of Cut, and Cutting Speed when Face Milling the 4-inch-wide Face of 20,000 psi (170 B) Cast Iron with a 9 inch diameter Face Mill with 16 Teeth Tipped with K2S Sintered Carbide and Ground to a Shape of +7, +4, 6, 6, 2, 0, .070" at 45°. A new 5HM, Kearney and Trecker Corp., Plain Horizontal Milling Machine was Used.

d Depth of Cut Inches	Cutting Speed FPM	Hpc	Cu. In. per Min.	Hpc	Cu. In. per Min.	Hpc	Cu. In. per Min.	Hpc	Cu. In. per Min.
		Cu. In. per Min.	Hpc	Cu. In. per Min.	Hpc	Cu. In. per Min.	Hpc	Cu. In. per Min.	Hpc
1/16	100	.61	1.64	.50	2.0	.41	2.44	.34	3.00
to	200	.61	1.65	.50	2.01	.41	2.46	.33	3.03
	400	.60	1.66	.49	2.02	.40	2.48	.33	3.03
1/2	800	.60	1.67	.49	2.04	.40	2.50	.33	3.03
		.0025		.005		.010		.020	
		f, Feed Per Tooth, Inches		Hpc/cu. in. per min. $= 0.113\, f^{0.29}\, d^{0}\, V^{0.01} = 0.113/f^{0.29}$					

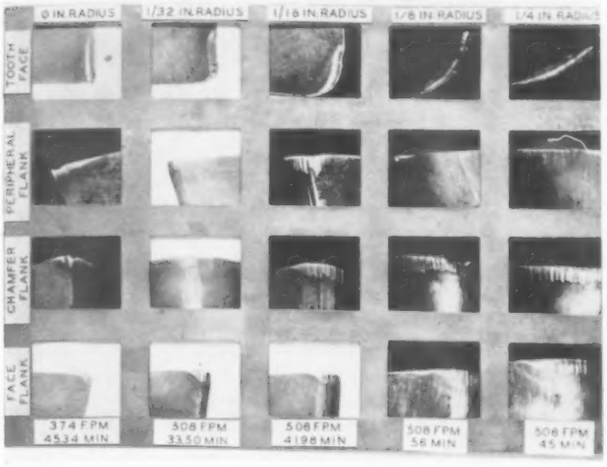


FIG. 20. Nature and amount of face cupping and peripheral and face relief on a single-tooth K2S carbide-tipped face-milling cutter 9″ in diameter. The nose of the tooth was varied from zero to ¼″ radius. The tooth shape was +7° axial rake, +4° radial rake, 6° peripheral and face relief, 0° peripheral-cutting-edge angle, and variable nose radius. "Meehanite" cast iron of 40,000 psi, 190 Brinell, was faced 4½″ wide and 0.10″ depth of cut. The feed per tooth was 0.010″.

low cost, free application of cutting fluid, adequate chip removal, fast and effective clamping, and proper lubrication. The practical considerations must come from the shop, and the practice available to one tool engineer may be quite different from that in another plant.

Progress has been made in setting up commercial standards of units which assist the tool engineer in arriving at a satisfactory solution of each problem. The application of pneumatic, hydraulic, and electrical units to operate chucks and fixture clamping devices are being standardized by the several manufacturers.

Competent sales engineers are available to suggest features and specific applications and they are becoming more and more a real help.

The welding of plates and structural shapes has advantages in cost for low production, but castings of gray iron still possess superior vibration absorption properties.

TABLE 5—TEST CONDITIONS AND RESULTS from Tests in which an 80 grit and a 150 grit wheel were used in cylindrical grinding. A 2-inch diameter test bar was used. Sixty complete passes were made.

TEST CONDITIONS—Machine, Cylindrical Grinder	
Material.....Specimen.....	SAE 52100 Steel
Hardness.....	62-64 Rockwell "C"
Tensile Strength.....	320,000 psi (approx.)
Wheel Speed.....	6500 surface feet/min.
Depth of cut.....	0.001 inch infeed per pass
Table Feed.....	26 inches/min. 0.081 inch/rev. of work spindle
Work Spindle Speed.....	320 rev./min. = 167 fpm
Total Wheel Infeed.....	0.120 inches on diameter
Grinding Compound.....	Water-Soluble, 5% by volume

A80J6V10	TEST RESULTS	A150J6V10
70.5	Volume Ratio, $Vm/Vw = Vr$.....	52.6
2.84	Net Horsepower, Hp_n.....	1.85
24.8	Grinding Characteristic, Vr/Hp_n.....	28.4
18.9	Hp/cubic inch per min.....	12.39
38.0%	Percentage Increase in Hp/cubic inch per min.....	6.0%
16°F	Temperature Increase on Work Surface (ΔT).....	12°F.
28	Surface Finish in Microinches (r.m.s.)....	29

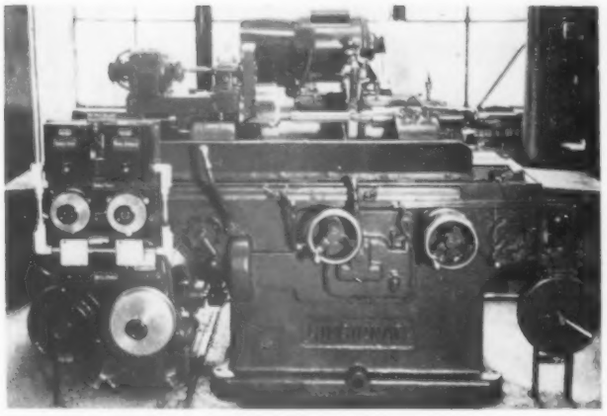


FIG. 21. A 10″ x 36″ cylindrical grinder provided with d.c. motors on the wheel spindle, the work spindle, and on the feed traverse, the speeds of which are controlled by field-type rheostats. A standard test specimen of SAE 52100 steel is mounted on centers.

Material for gages now include glass, boron carbide "Norbide," and even sapphires, in addition to the generally used tungsten carbide. Surface coatings such as chromium plating and nitriding are also commonly used. Glass has the property of retaining its geometrical shape even though scratched and the other materials give greatly increased life because of their hardness. The American Gage Design Committee's standards of design are being used generally. Great advances in designating and measuring surface quality have removed many uncertainties.

Die design and making is a highly specialized field. The operation of dies is dependent on the materials worked in them and while progress in mill practice is being made continually, a real understanding of drawability in dies is still lacking and the tool engineer must rely on previous experience. The manufacturers of sheet magnesium, aluminum, copper alloys, and steel are all working effectively in this dual program.

The extrusion of formed bars is a field closely allied to drawing and frequent publications bring forth special alloys or pertinent data to help the manufacturer use these materials more effectively. Every process helpful in furnishing materials and fabricating them for manufacture is undergoing constant development and expansion. A new field such as the molding of plastics with its varied problems is introduced only to stimulate further development in die casting, permanent mold casting, precision casting, and even the competitive fields of stamping and welding. It's a marathon race of keen minds. Unending study and trial are necessary. The over-all picture is so extensive and varied that the tool engineer must of necessity learn "more and more of less and less" and become a specialist.

New Finish for Plastic Molds

Of particular interest to plastic mold makers, a new mold polishing service is announced by Acme Scientific Company, 202 No. Laflin St., Chicago 7. The new method, which is primarily based on lapping and optical polishing, is said to provide for flawless polishing to a mirror finish, thus providing a more perfect finish to molded parts than attained under previous methods of mold finishing.

The Acme lapping operation, which is essentially mechanical, removes imperfections and cleans up the surface after deep tool marks have been removed, then, the precision polish is put on. Finish is uniform, and optical polish can be attained if desired.

By A. E. Rylander

A New "Tool of Today" Meets Postwar Production Demands

High Productive Capacity, Safety and Convenience Feature a Machine Designed for Simplified, "All Carbide" Tooling

NAMED THE **"CHUCK-MATIC,"** a new 12-inch capacity single spindle automatic chucking machine, announced by *The National Acme Co.*, 170 East 131st St., Cleveland 8, is a radical departure from previous single spindle chuckers and is entirely in line with modern trends in machine tool design, pointing toward higher productivity and lower manufacturing costs.

Heavy duty, high production machining operations on castings, forgings, and tubing parts up to 12 inches in diameter can be effectively performed on the new Acme-Gridley chucker, which has been especially developed for straight, internal or taper boring, form turning or form boring, external turning, forming, facing and chamfering. Use of carbide tools, high production work, short-run job shop operations, high cutting speeds and feeds, fatigue, safety and inexperience of operators have all been considered in some definite manner in the design.

Better control of set-up time is one of the features. A single chuck holds the work and only two slides need to be tooled. Slide tools are mounted in the most accessible position and machining cycle may be instantly interrupted for re-setting tools during set-up by pushing one lever to stop feed and operating another lever to reverse slides.

Finally, cams controlling working and clearance cycles of tools are placed where they are very easy to get and set. Simple in design and construction, only a rudimentary knowledge of machinery and machining operations is necessary to quickly master the simple four-step operating sequence.

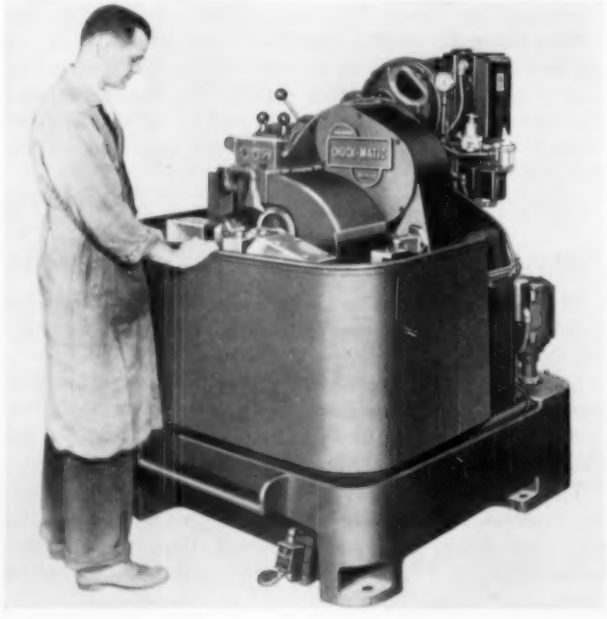
Work handling is extremely convenient, as the operator is always in position at front of machine, with all controls easily reached and the work chucked from the front. One person may operate as many machines as the cycle time of the job will permit, one machine being loaded while another is cutting.

An operator can turn out parts at high production rates with only normal physical effort. Chuck is positioned at natural elbow height, and but 14 inches from main splash guard's front edge. The slides are well retracted from chucking zone to rid that area of annoying obstructions during chucking, and as the chuck jaws are opened and closed by air power controlled by a foot pedal, practically no physical effort is required for its operation.

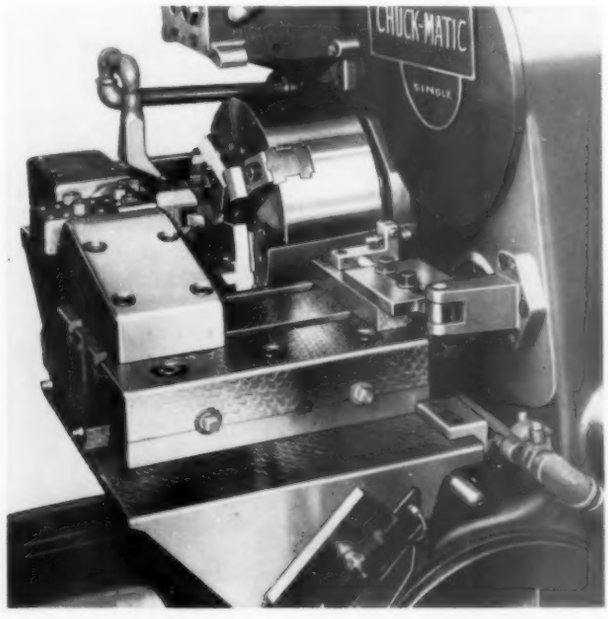
Without going into involved details, which are available from the maker, it is of interest that the design incorporates but two main castings—the heavy pan and one piece frame —which are doweled and bolted together as a rugged, compact and practically vibrationless unit weighing almost 3½ tons. It takes up but 45" by 64" floor space.

Designed for "all carbide" tooling, the rugged construction admirably serves the purpose of tool conservation, and surface speeds are such as to obtain maximum efficiency with carbide tools. Tool slides follow ultra modern trends and are set in angular positions and supported without overhang. Also, every possible thought seems to have been directed to operation safety. For example, a snap-back unit switch prevents the foot pedal from operating to open the chuck while in motion, and if air pressure falls below a safe minimum, the machine stops. Furthermore, the spindle cannot turn when the operator's hands are in the danger zone, as both hands are forced from the machine when cutting starts. Other safety devices guard the machine from damage.

The "Chuck-Matic" single spindle chucking machine. Note the "toe room" and convenient controls and working position.



Close-up of tool slides. Note the rugged construction and the solid tool blocks, operating without overhang.



Electric Units and Their Relation to Measurement

Part 1 of 2

Electric and magnetic actions being forms of energy, and being mutually convertible, are subject to all the laws governing transformations of energy.

Work is done when conductors are moved in magnetic fields, the resistance to movement and the amount of movement determining the amount of work done.

The unit of mechanical *work* is a *foot-pound*, by which name we designate the work done in lifting 1 pound 1 foot against the action or *force* of gravity.

Force, by which we mean the cause of action or movement (pulling or pushing ability), is measured in pounds, and *force* multiplied by the *distance* through which it acts is *work*. Lifting 10 pounds 10 feet = 100 foot-pounds. Exerting a push of 10 pounds for 100 feet = 1000 foot-pounds.

The amount of work done in a given time—that is, the *rate* of doing work—is called *power*. The unit of mechanical power we call a horsepower, and it represents a rate of doing work equal to 33,000 foot-pounds per minute, or 550 foot-pounds per second.

In the above definitions of work and power the *units* of *distance*, *weight*, and *time* are the *foot*, *pound*, and *minute*, all of which are defined by law and are called *fundamental units*.

Metric System Used

Another system of units, proposed by the British Association for the Advancement of Science and now generally used in electrical measurements, is based on the *centimeter*, *gram*, and *second*, and is usually called the c. g. s. system. The use of this system is authorized by law and is universal in scientific work.

The following relations exist between the two sets of units:

1 foot = 30.48 centimeters, approximately.

1 pound = 453.59 grams, approximately.

1 minute = 60 seconds.*

**The unit of time is based on a fundamental unit, being a fraction of the time of a revolution of the earth, and this unit is common to both systems. The foot and the pound are really arbitrary units. The centimeter is a fraction of a fundamental unit, namely, of the distance from the equator to the north pole on a certain meridian. The gram is the weight of a cubic centimeter of distilled water. It is an arbitrary unit. The units of length and weight in the United States are kept at the Bureau of Standards in Washington, and the unit of time is determined by the Naval Observatory in the same city.*

The unit of *force* in the c. g. s. system is that force which, acting on a gram mass for 1 second gives it a velocity of 1 centimeter per second. This force is called a *dyne*. The force of gravity acting on a gram mass for 1 second will give it a velocity of 32.2 feet per second = approximately 981 centimeters per second; therefore the force of gravity is equal to 981 dynes and the pull of a dyne represented as a weight is equal to 1/981 of a gram. The pull of a pound, which equals 453.59 grams, must be equal to that of 453.59 × 981 = approximately 445,000 dynes.

The unit of *work* in the c. g. s. system is the work done in overcoming the force of 1 dyne through 1 centimeter, and is called and *erg*. In other words, an *erg* is the work done in lifting 1/981 of a gram 1 *centimeter*. An *erg* by definition is a dyne overcome through a centimeter, and we see that a *foot-pound* is 445,000 dynes overcome through 30.48 centimeters; therefore a *foot-pound* equals 445,000 × 30.48 = approximately 13,570,000 ergs, and a horsepower, which equals 550 foot-pounds, per second = 13,570,000 × 550 = approximately 7,460,000,000 ergs per second.

The c. g. s. units of length (centimeter), time (second), force (dyne), and work (erg) are employed to define the *absolute* units used in electrical measurements. These are *electro-motive force*, *current*, and *resistance*. From these are derived the so-called *practical* units in daily use—*volt*, *ampere*, and *ohm*.

Terms Must Be Memorized

On account of the fact that the names adopted for the practical electro-magnetic units are all names of noted scientists and not related to nor in any way descriptive of the qualities they are used to designate, their acquirement must be entirely a feat of memory. They can be more easily remembered by associating them with the names of the theoretical or absolute units. As, for instance, we say an E. M. F. of 125 volts, a current of 40 amperes, a resistance of 10 ohms.

By agreement among electricians, electro-motive force is represented by the letter E; electric current by the letter I; resistance to the flow of electricity by the letter R; time by the letter T; work by the letter W; power by the letter P. The object now is to determine the relation of these quantities to each other.

We know that it requires work to move conductors in magnetic fields, or one magnet in the vicinity of another, and the movement generates an E. M. F. in the conductor, and also a current, if the conductor forms a closed circuit. And we also know that the amount of current produced by a given E. M. F. depends on the resistance of the conductor.

We say that the E. M. F. and current are produced in the circuit because it cuts the lines of force of the magnetic field. We must, therefore, have a definite idea or agreement

A new series, in the *Fundamentals of Tool Engineering*, was interrupted due to pressure of work in connection with the recent A.S.T.E. New Era Exposition. To fill the gap, we present an article on *Electric Units and their Relation to Each Other*, by Dr. John Caton.

While not original, inasmuch as Dr. Caton has previously used it as text material, the article is nevertheless of considerable value in acquainting engineering students, and others, with the terms and nomenclatures of electrical measurement. It should therefore be filed with other articles appearing in this Department. —*Ed.*

as to exactly what is meant by the term, lines of magnetic force, and how they are connected with E. M. F. and current.

The physical basis for the term is the action of iron filings in the field of a magnet, but to make a definite basis for measurement it has been agreed, first, that a unit magnet pole shall be one that when placed at a distance of 1 centimeter *in air* from a like pole of equal strength, is repelled by a force of 1 dyne.

Second, if a unit pole, as defined below, is placed in a field of force of such strength that it is acted upon (attracted or repelled) by a force of 1 dyne, such a field is a unit field and shall be held to contain one line of force per square centimeter. It is further agreed, third, that unit E. M. F. shall be that generated by moving a conductor across unit field, so that it cuts 1 square centimeter (1 line of force) per second.

Fourth, if this conductor forms part of a closed circuit, and if the current generated by this unit E. M. F. is such as to cause the movement of the conductor to be resisted by a force of 1 dyne, it is agreed that the conductor has unit resistance and that the current produced is unit current. The work done is 1 erg per second, equal to a dyne (1/981 gram), lifted 1 centimeter.

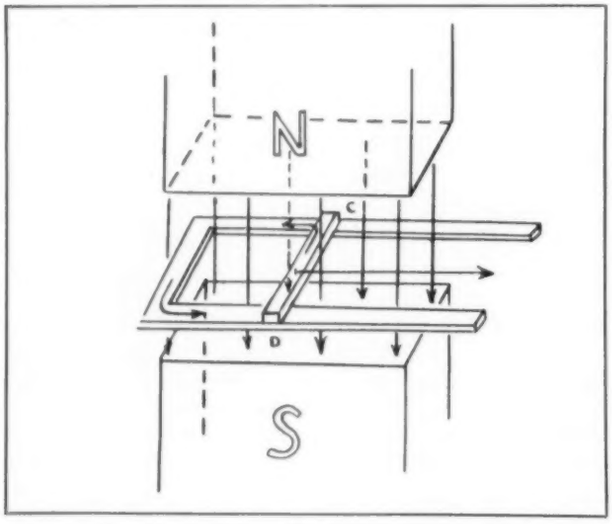


FIG. 1.

Since power is rate of doing work, we can say it requires unit power to produce unit E. M. F. or unit current in a circuit of unit resistance. Let Fig. 1 represent unit magnetic field between two magnet poles N and S. Let C D represent a conductor one centimeter in length moving at right angles to this field at the rate of one centimeter per second, and making sliding connections at its ends with a very heavy conductor whose resistance, as compared with C D, is so small that it can be neglected and the resistance of the circuit considered as concentrated in C D.

Then, if it requires a pull of 1 dyne (1/981 gram) to keep C D moving at the rate of one centimeter per second, C D has unit resistance, unit current flows, and, by definition, unit E. M. F. is generated. If the speed of C D is doubled, the E. M. F. is doubled and the current (as shown by the effects) is also doubled, we can express this by saying: (a) Current varies directly as E. M. F.

If the size of C D is doubled (the speed and, therefore, E. M. F. remaining the same) the *resistance* is reduced to one-half, and we find that the current is doubled as before; we say: (b) Current varies inversely as resistance. Combining (a) and (b) we can say current = E. M. F./resistance or $I = E/R$ (1).

Equation (1) is the fundamental electrical equation and states in mathematical form what is known as Ohm's law, viz: "The current in any circuit varies directly as the electro-motive force, and inversely as the resistance in the circuit." We also find that doubling the current doubles the opposition to movement and, other things remaining the same, doubles the work per second, or the power. Power, therefore, varies directly as the current.

Doubling the speed of movement doubles the electromotive force and also the current, but it quadruples the power or work done per second since it represents a pull of 2 dynes through 2 centimeters in 1 second. Power, therefore, varies directly as the E. M. F., as well as directly with the current, and we say that it varies as their product, or $P = I E$ (2) or from (1) $P = E^2/R$ and $P = C^2R$. The foregoing are physical facts determined by observation and experiment.

Since magnetic fields containing 20,000 lines of force per square centimeter can be obtained, a rate of cutting of one line per second gives too small a unit of E. M. F. for practical use.

On the other hand, the current necessary to produce a resistance of 1 dyne to this slow movement in unit field is somewhat large, therefore to replace the *theoretical* or *absolute* units, as defined in art. 114, the so-called *practical* units have been adopted.

The Practical Units of Measurement

Volt. The practical unit of E. M. F. is the *volt* and is the E. M. F. generated when lines of force are cut at the rate of 100,000,000 per second.

Ampere. The practical unit of current is the *ampere* and is one-tenth of the theoretical or absolute unit.

Ohm. In order to maintain the truth of the equation $I = E/R$ (1), the practical unit of resistance, which is the ohm, is taken as 1,000,000,000 times the theoretical or absolute unit.

Ohm's law then still remains true. $I = E/R$ or amperes = volts/ohms because this equation in terms of the absolute units is I/10 (amperes) = E × 100,000,000 (volts) /R × 1,000,000,000 (ohms), which is the same as $I = E/R$. The *size* of the *units* has been changed, but the proportion between them is the same as before.

Watt. The practical unit of power is the *watt*, which is the ergs of work done per second when 1 ampere is made to flow with an E. M. F. of 1 volt. This in ergs (see equation (2)) equals unit E. M. F. × 100,000,000 × unit current/10, or 10,000,000 ergs per second. Therefore 1 watt equals 10,000,000 ergs per second. The power expended in any circuit in watts equals the product of the volts and amperes in the circuit, or $P = IE$ (2). Ten million ergs of work is called a *joule*. Therefore a watt = 1 joule per second.

We have seen that 1 H. P. = 7,460,000,000 ergs per second. Therefore 1 H. P. = 746 watts. 1 watt = approximately 0.737 foot-pounds per second.

After having selected the practical units, it became necessary, for the purpose of comparison and for everyday use, to represent them in practical form, because the accurate measurement of dynes and ergs is a very difficult matter practically, but it can be done in accordance with given definitions.

Part Two, which concludes this article, will follow in the July issue, The Tool Engineer.

TOOLS OF TODAY

Because of accelerating invention, and development of new tools designed to cut manufacturing costs, our Tools of Today department has been expanded to six pages. Due to the growing demand for space in *The Tool Engineer*, however, mention will, for the time being, be mainly introductory and confined to salient features.

Having thus introduced equipment of vital importance to industry, we suggest that readers obtain complete details and specifications from the makers, whose addresses are given.

Ed.

New Landis Thread Grinder

ANNOUNCED over two years ago by *The Landis Machine Company*, Waynesboro, Pa., as a postwar product, the new **LANDIS UNIVERSAL CENTERLESS THREAD GRINDER** is now available for grinding screw threads on straight cylindrical workpieces as well as on headed or multiple diameter parts. The machine incorporates all essential mechanisms and controls for grinding by either the "Thrufeed" or "Infeed" methods, and it is only necessary to apply the proper tooling for any specific operation.

Single diameter workpieces such as set screws, long rods, and rings are thread ground by passing the workpieces in a continuous flow—"the Thrufeed Method"—between the grinding and regulating wheels. This method can be used to grind threads from either solid blanks or to finish threads pre-cut prior to centerless thread grinding.

Headed or shouldered capscrews, headed adjusting screws, stripper bolts and similar multiple diameter parts are centerless thread ground by the "Infeed Method." This operation completes the entire thread in approximately one and one-half revolutions of the workpieces, which are placed between the wheels one at a time and are automatically ejected at the completion of thread grinding operation. This method of grinding may be used for grinding either pre-cut threads or from the solid and is frequently used when the threads must be concentric with unthreaded diameters.

The machine is of very sturdy construction and designed for maximum convenience. Grinding and controls wheels can be dressed without disturbing the set-up and, operating controls are centralized at the front with all mechanisms enclosed and protected from grit and coolant.

Taken as a whole, the machine is designed for maximum production consistent with extreme accuracy. Profile diamond type dressers, over the grinding and control wheels, provide for forming the wheels to any desired contour; in addition, a heavy automatic crush dresser is attached directly to the bed, for forming thread forms. Efficiency is such that, on thrufeed grinding, size adjustments may be extended over several hours continuous operation, with dressing of the wheels ranging up to eight hours.

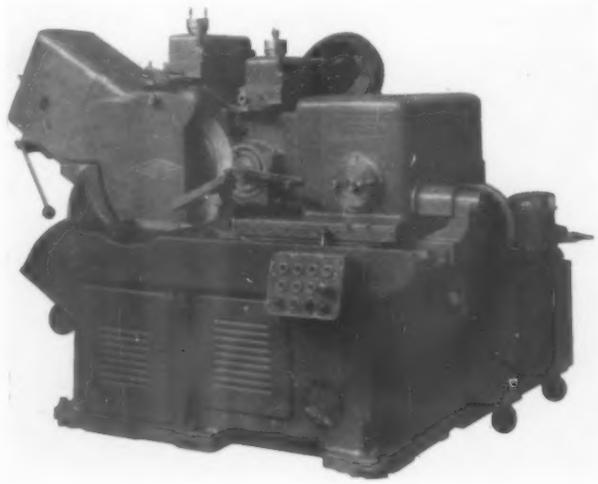
Size adjustment is facilitated by a large micrometer dial, reading to .0001" and can be set to zero whenever desired. Also, an automatic hopper is available, enabling one operator to handle a battery of machines.

Versatile Centerless Grinder

A precision **CENTERLESS GRINDER**, by Lidköping Mekaniska Verkstad A.B. (Inc.), Div'n of S K F Ball Bearing Corp'n, Sweden, has a range from small multi-diameter parts to shafts 6" dia. x 25' long. The machine is extremely versatile and, due to its accurate high productivity, its introduction to American industry is particularly timely in view of sharply rising labor costs.

Spindles, both grinding and regulating, are supported by bearings on both sides of the wheels. Hence, there is spindle rigidity to enhance accuracy and to increase production. On steel shafts, for example, a through feed of 100 ft. per minute, with stock removal up to 100 lbs. per hour, has been attained. The machine can be used for through feed and in-feed (plunge-cut) grinding, and a wide variety of attachments adapts it to profile grinding and the grinding of bars, tubes, twist drills, straight and tapered textile spindles and an almost endless variety of odd shaped parts.

Exhibited at the recent A.S.T.E. New Era Exposition, the machine was one among a number that attracted more than usual attention. There, the work exhibit consisted of grinding a valve guide having three diameters in addition to grinding a shoulder and a 30° tapered seat, at one setting, at a production rate of 80 to 100 pieces per hour. The machine is being currently demonstrated by *Triplex Machine Corp'n*, 125 Barclay St., New York 7, from whom complete specifications may be had.

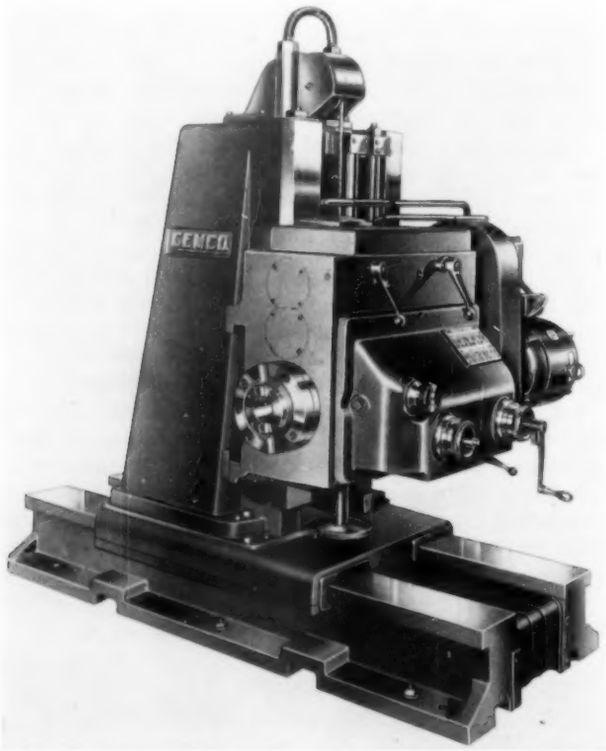


New Gemco Machine

As THE LATEST addition to their line of precision machinery, *The General Engineering & Mfg. Co.*, St. Louis 4, Mo., announces the **BORING AND FACING MACHINE** shown below. This machine, often used in multiples, is widely applicable to boring, facing, back facing, drilling, and tapping operations on surfaces of heavy, cumbersome workpieces which may not be accessible to standard machine tools.

An outstanding feature is the unusual mounting of the spindle housing which, with its spindle nose of fixed position in relation to the bearing, 4.25", is advanced toward the workpiece. By avoiding long overhang, this construction greatly reduces vibration, increases permissible feed and depth of cut, and assures machining to very close limits with a resultant decrease in production time.

The machine may be used either as a stationary machine in a permanent position with the work brought to the machine, or as a portable machine, in which case it is taken to the work. A retractable spindle is offered, at extra cost, should the machine be used extensively for drilling operations. It can also be modified and provided with automatic feed mechanism, to be used as a milling machine. Complete specifications may be had in a new illustrated catalog (No. GB-14), available on request.



Non-Rancid Grinding Fluid

A NEW WATER soluble grinding fluid, that cannot develop rancidity, is announced by *Quaker Chemical Products Corp'n*, Conshohocken, Pa. Designated as **QUAKER MICROGRIND 70**, the new fluid can be used with excellent results on abrasive operations on all kinds of steel and most other metals. The maker claims that it cannot become rancid, nor will it develop odors, even when mixed with extremely hard water or when used for grinding cast iron. It is further claimed that it can be used for three months, or more, without change if make-up is added periodically, and that it will not cause build-up on machines, rather, tends to keep them clean.

Precision Internal Grinder

Superior Machine & Tool Works, 528 Butterworth S SW., Grand Rapids, Mich., announces a new **PRECISIO INTERNAL GRINDER**—JY No. 2—with the flexibili to grind radii and tapers on tool and die parts as well a wide range of toolroom work, from ¼" dia. up, wi absolute precision.

Compact, and taking up 36" x 68" floor space, the machi swings 10½" with 11" longitudinal travel. Spindle speed range from 12,000 to 27,000 rpm and work head speed 200 to 400 rpm. As a time saving feature, the machine doe not have to be stopped to measure work; instead, a hand lever throws the machine out of gear and applies brakes.

Diamonds in Vitrified Bond

SUPPLEMENTING their regular line of diamond abrasives, a new **VITRIFIED BOND**, by *Bay State Abrasive Co.*, 21 Union St., Westboro, Mass., is said to give excellent results on the grinding of carbide tools and other super-hard substances.

With this development, the unparalleled abrasive power of diamonds gains the advantages of vitrified bonding, such as great strength and faster, cooler cutting action. These factors add considerably to the known high economy and efficiency of diamond abrasive grinding.

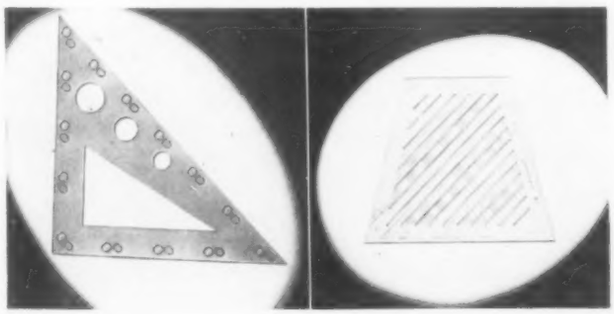
New Kent-Owens Miller

A NEW **VERTICAL MILLER**—Model 2-20—is a recent addition to the line of milling machines manufactured by the *Kent-Owens Machine Co.*, Toledo, Ohio. An unusual feature of this machine is independent adjustment of the feed rate for opposite direction of table travel, as a result of which a part may be milled at one end of the table, at slow feed rate, while setting up an entirely different job, at the other end, requiring a higher feed rate. This also permits setting the feed rate exactly the same for both directions of table travel.

Construction is rugged and simple, with the heavy table guided by dovetail sliding cast integral with the bed. The table is automatic cycle, 42" long x 12" wide, with 20" travel, and can be fed or rapid traversed in either direction and automatically shifted from r.t. in either direction and automatically reversed at both ends of stroke. It can also be automatically stopped at any point of travel.

Improved Drafting Tools

Two NEW drafting instruments, by *Instrumaster Industries*, 73-97 Arch St., Greenwich, Conn., save time on the board and are also conducive to neater drawings. The "Instrumaster" **FLOATING TRIANGLES**, shown at left, have fingerlifts at all points on both inside and outside edges, have perfect inking edges, minimize smudging and minimize 45°—30°—60° shifting due to embodying all three angles in the one tool. They are available in sizes 4", 6", 8", 10" and 12" in both 45° and 30°-60° types.

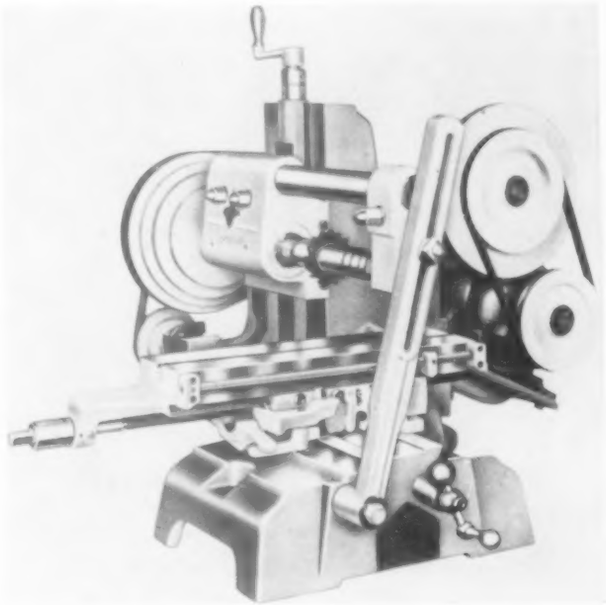


The **HATCHING STENCILS** (right) provide for easier and quicker hatching, as the precise marking predetermines the exact location of the lines. Both tools are made of non-inflammable plastic stock and are guaranteed non-warping.

New Bench Miller

A NEW **BENCH MILLER**—the Armor by *Aircraft Machinery Corp'n*, Burbank, Cal., is said to incorporate performance characteristics usually found only in larger machines. Weighing but 320 lbs., stripped, the Armor has a rise and fall spindle, thereby eliminating the knee, with its possible inaccuracy, and the spindle is provided with standard lathe threads to provide for chuck and face plate mountings in the event that the machine should be used for lathe operations.

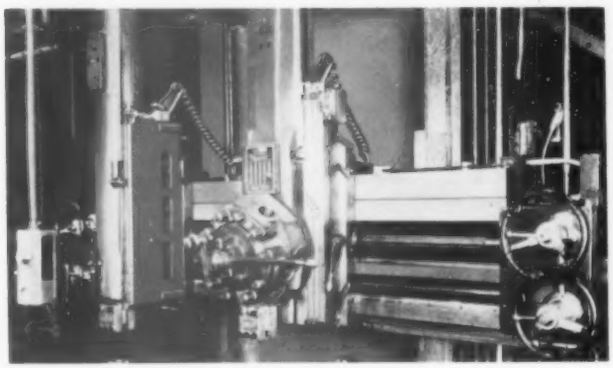
Hand screw feed is standard; however, lever feed assembly is optional and the machine can also be provided with a fully automatic power feed. The machine will swing 22", and is said to be accurate enough for jig boring.



"Koiled Kords" for Safety

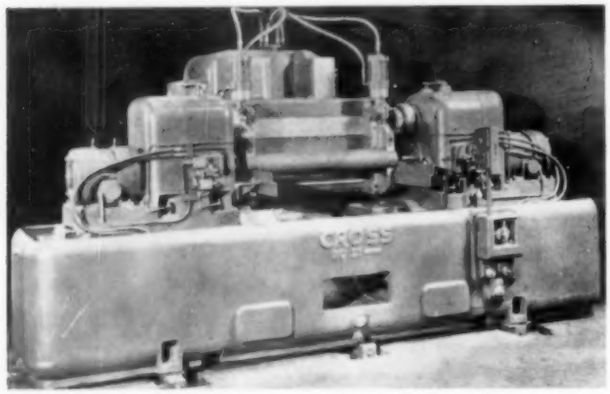
DEVELOPED for heavy industrial use by *Kellogg Switchboard Supply Company*, Chicago, two **KOILED KORDS**, as they are named for the trade, are shown applied to a Bullard 54" Cut Master Type Vertical Turret Lathe. Both turret head and ram on this advanced Bullard model have electrically-controlled and hydraulically-operated stop features controlled by two permanently positioned solenoids and micro-switches mounted on the carriage of each head.

Solenoids and micro-switches are connected by Koiled Kords which stretch and retract to suit the horizontal or vertical traverse of either head. Their use, widely applicable to industrial equipment, eliminates the danger of operational interference which might be caused by tangling or looping of conventional type cords.

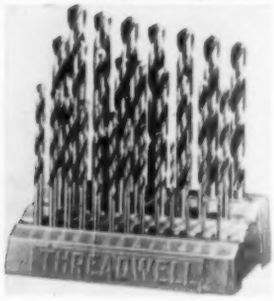


Facing and Centering Machine

A NEW **UNIVERSAL MACHINE** by *The Cross Company*, 3250 Bellevue, Detroit, is designed for facing and centering shafts in sizes from 1¼" to 6" diameter by 9" to 48" long. Cutting rigidity is insured by supporting both the work, regardless of length, and the cutters at the point of cut. The machine is full automatic cycle, controlled by push button, and the shafts are rolled on loading rails into the clamping jaws and hydraulically clamped on each end. The work then feeds up to mill both ends, when the carbide cutters retract and the work lowers for centering and unloading. The hydraulic feeding and traversing heads connected with the work clamps are quickly and easily positioned to change from one size shaft to another, the average changeover time being about ten minutes. Output is at the rate of 50 average shafts faced and centered per hour.



High Speed Twist Drills

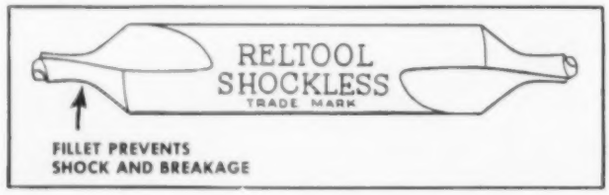


A COMPLETE LINE OF **HIGH SPEED TWIST DRILLS**, matching in quality and accuracy Threadwell High Speed taps and other cutting tools, is announced by *Threadwell Tap & Die Co.*, Greenfield, Mass. The line includes t.s. drills in all standard sizes up to 1½", and s.s. in wire gauge sizes and taper and jobbers lengths.

Sets of high speed s.s. drills are offered in sturdy and convenient metal stands, as illustrated, in jobbers lengths from 1/16" to ½", by 64ths, and in wire gauge sizes from No. 1 to 60. Complete details to be had in Threadwell Bulletin No. 435.

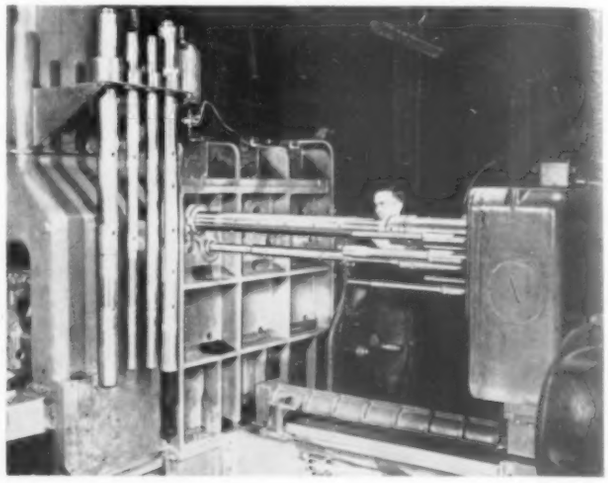
Shockless Center Drill

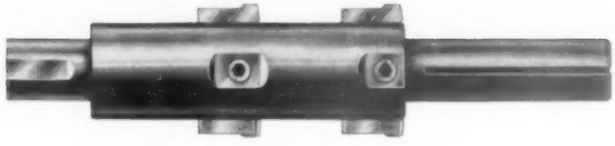
A COMBINATION **CENTER DRILL** of new design, by *Reltool Corp'n*, Milwaukee, and available in all standard sizes, promises longer life and less breakage as a result of a fillet incorporated at the point where 60° countersink angle meets the tip. This smooths out the usual abrupt transition from the straight flute of the tip and, by spreading strain and shock over a greater area, eliminates the main cause of shock and fatigue in the otherwise perishable tools.



Boring Bars Simplify Change

PROBLEMS incidental to complex boring operation a greatly simplified by use of standard and **SPECIAL BOR ING BARS** and **CUTTERS**, as designed and manufa tured by *Davis Boring Tool Div'n* of Giddings & Lew Machine Tool Co., Fon du Lac, Wis. These bars and cutte may be modified to suit specification changes in machine parts, thereby holding down inventory of capital machin equipment.





Davis plain and block type boring bars are made in a wide range of designs for various needs. As, for example, soft bars for occasional boring, and carburized and hardened bars for resistance to wear on high production runs. Both line and stub bars are available for simultaneous multiple cuts; with these tools, roughing, semi-finishing and finishing can be done at a simple pass.

Mobile Elevating Conveyor

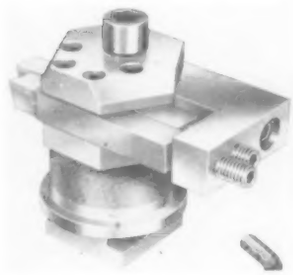
A MOBILE, adjustable, **ELEVATING CONVEYOR** is available from *Island Equipment Corp.*, 101 Park Ave., New York 17. Mounted on 4 steel casters and adjustable from 10 to 45 degrees, with maximum elevation 16 feet, the conveyor covers a considerable range and solves problems incidental to lifting material from one level to another. The belt, cleated at 5 ft. intervals, travels 50 fpm.

Flash Freezing Unit

USING DRY ICE instead of refrigerating gas, the recently announced **FLASH FREEZE UNIT**, by *Super Treat, Inc.*, 3412 Beekman St., Cincinnati 23, is said to be a radical new development for industrial cold treatment. Contrary to claims that extremely low temperatures cannot be obtained with dry ice, the unit can be cooled from room temperature to −130° F. in about two hours.

Furthermore, this low temperature can be readily attained and accurately reproduced as, if shut down for an extended period, the unit can be ready, for almost immediate use by simply adding dry ice. Furnished with standard or special baskets, the unit is recommended for all cold treating operations such as shrink fits, gage stabilizations and tool treatment. Performance is guaranteed by the maker.

Tool Adjustment Block

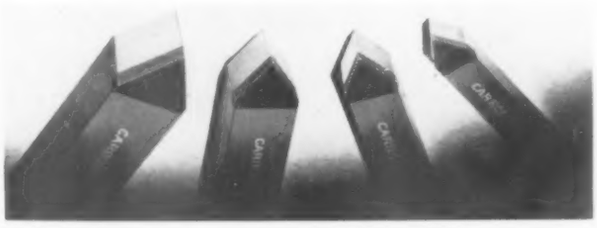


A **TOOL ADJUSTMENT BLOCK**, for use with the Howard Tool Holders and to be mounted on either side of the holder, is announced by *Howard Dearborn, Inc.*, 3370 W. 140th St., Cleveland. The slot design facilitates ease of changing tools, or angle of tool setting, without changing the position of the tool holder.

The holder is easily installed for right or left hand turning or multiple changing, and has set screws for adjusting either tool when combination tooling is used. Because of these features, errors are said to have been reduced manifold as compared to results with conventional tool holder.

Carboloy Threading Tools

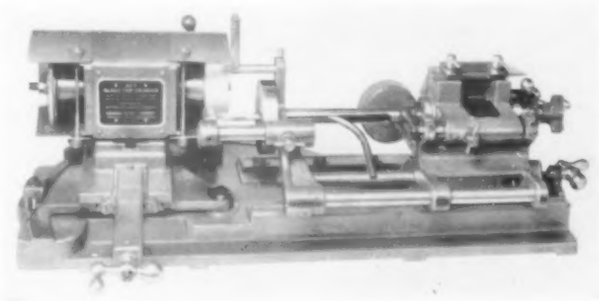
A NEW LINE of standard carbide tipped **THREADING TOOLS**—Style T-15—has been added to the standard line of stock tools by *Carboloy Company, Inc.*, Detroit, Mich. Available for immediate delivery in any desired quantity, the tools are of the 60° V-nose type, with tips of Carboloy Grade 78-B. This is a tough and wear-resistant grade of carbide, particularly suitable for long run threading of steel parts.



Shank sizes include $\frac{3}{8}$", $\frac{1}{2}$", $\frac{5}{8}$" and $\frac{3}{4}$" square styles, in lengths from $2\frac{1}{2}$" to $4\frac{1}{2}$". Primary clearance at the nose of the tool is 3°, with a secondary clearance of 6°. This design provides free cutting while insuring ample support for the nose of the tool tip.

New Thin-Body Chuck

DESIGNED TO REPLACE collets, a new type of **UNIVERSAL CHUCK** is now available from the *Edward Blake Company*, 624 Commonwealth Ave., Newton Center 59, Mass. The chuck, which is thin bodied, depends on a single, pinion operated, 3-lobe cam to actuate the jaws. The turn of an Allen wrench closes the jaws, which open by springs when pressure is relieved.



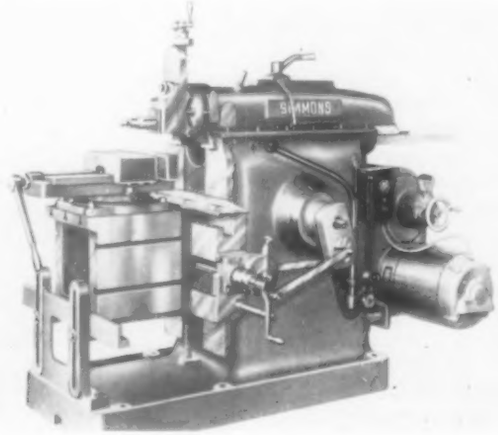
The chuck, which has a powerful, positive grip, was especially developed for the Bent Shank Tapper Tap attachment used on the Blake Tap Grinder (illustrated) and, as so used, the thin body allows the insertion, shank end first, of bent and hook shank taps; also, it enables gripping the shank close to the threads, when concentricity is greatest.

Range is from $\frac{1}{16}$" to $\frac{9}{16}$", so that the chuck replaces the several collets ordinarily required for taps—or other work—in this range. The thin-body design, which can be widely applied, is particularly advantageous for applications where overhang must be held to a minimum or where work area is limited. The company is prepared to design and manufacture chucks, on the thin-body principle, to suit individual requirements.

New Simmons 20" Shaper

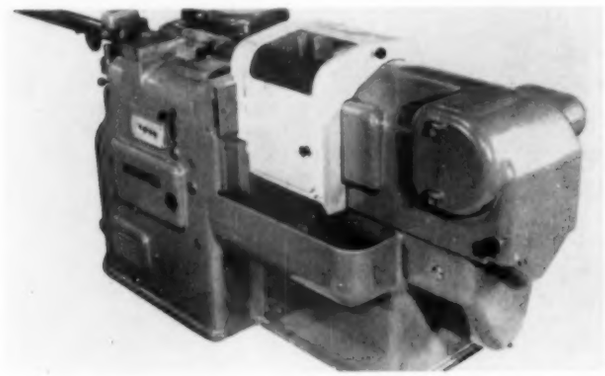
A NEW 20" **SHAPER**, named the Micro-Speed, is announced by the *Simmons Machine Tool Corporation*, Albany, 1, N. Y. The machine incorporates a variable speed drive which gives an unlimited range of speeds to the ram at the turn of a hand wheel and, according to the manufacturer, is equally suited to heavy production work and exacting tool room requirements.

Ram stroke is $20\frac{3}{4}$" maximum, horizontal travel 23", vertical travel and the table to ram distance $16\frac{1}{2}$". Feed range is from .006", for finishing, to .080" for roughing cuts. A heavy duty vise swivels 360°. The machine is ruggedly designed, with drive through a dry multiple disc clutch, easily adjusted, and all drive gears helical for smooth, quiet operation.



New Tavannes Automatic

INDEPENDENT CONTROL of twelve individual working tools, in the Tavannes **SINGLE SPINDLE AUTOMATIC** (marketed by *Commentry Industries, Inc.*, 260 W. B'way, New York 13), permits carbide tooling to be used for all operations common to screw machines. Because of several fundamental differences in design, it is believed that these Swiss automatics represent an entirely new approach to screw machine construction. Working positions are divided into six stations for side slide operations, and six turret positions in which the tools can be independently rotated when a turret unit containing six revolving spindles is in use.

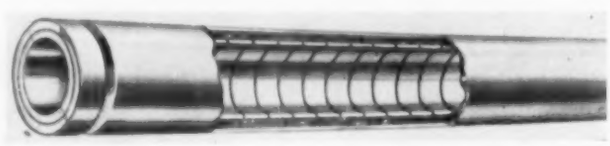


Stock feeding is done by recoiling the headstock spindle back along the bar stock to the desired point of gripping, when the stock is fed forward through a revolving guide bushing, past the side slide tools and into the turret tools as the latter are sequenced into working position. Feeding tension on the bar is maintained by an electric servo-motor. The guide bushing, held close to the cutting action, permits unusually long work to be effectively machined without the use of separate stock rests. Close size tolerances can also be held and turning-behind-shoulder work and generation of complex shapes are also simplified by this method of turning.

The Tavannes screw machines are built in two capacities; the M-40, for bars up to 1⅝", and the M-60, which handles 2⅜" bar stock. Maximum turning length with standard tooling is 7⅛", and work up to 9" can be turned with a special tooling arrangement. However, the headstock unit can be recoiled twice to permit work up to 18 inches in length to be effectively turned. The machine will chuck work up to 4" diameter when arranged to handle castings, forgings, and cut lengths of stock. Threading capacity, using split or self opening dies, is ¾" for threads up to 25 pitch; for finer threads, the capacity is 1½". Weight of each model is 5500 lbs.

Silent Stock Tube

A SILENT **STOCK TUBE**, manufactured by the *Corlett-Turner Co.*, 4011 W. Lake St., Chicago, is applicable to both single and multiple spindle automatic screw machines. Tested and proved in several thousand field installations, this product is becoming increasingly popular with the screw machine industry because it eliminates the clatter caused by revolving bar stock. The device consists of a helically wound, wear resistant steel liner, covered by sound absorbent material and encased in a steel tube to form a compact, rigid, and efficient silent stock tube.



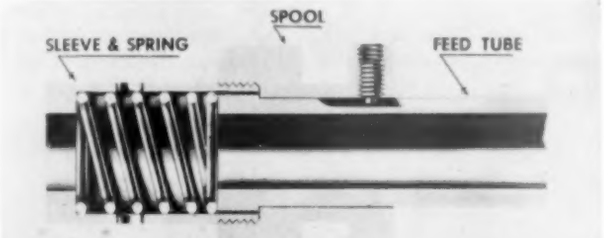
Pneumatic Bar Feed

A **PNEUMATIC BAR FEED**, by *Lipe-Rollway Corp'n*, Syracuse, N. Y., is claimed to increase output of screw and turret machines as much as 20% as compared to manual fed machines. For Brown & Sharpe automatics, and small hand screw machines, the Lipe Bar Feeds are now furnished with newly designed pedestals which offer several advantages over previous designs. The pedestal bases are smaller, for installation in crowded spaces, and the control cabinet has been moved adjacent to the machine, permitting the operator to make necessary adjustments from normal working position.

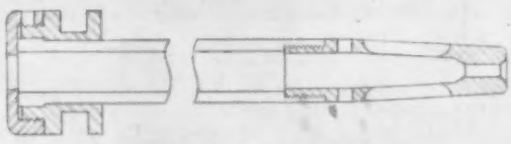
Shock Absorbing Feed Tubes

Modern Collet and Machine Co., 401 Salliotte St., Ecorse 18, Mich., announces a complete line of shock-absorbing **FEED TUBES** for Brown & Sharpe automatics of all sizes and models which do not have a spring safety device incorporated in the feeding mechanism of the machine.

With these feed tubes, forward movement of the screw machine feed latch is transmitted from the spool to the tube itself through a sleeve and helical compression spring which permits normal feed without deflecting. In case of interference with advance of the feed tube, or with full advance of the stock itself, the spring compresses and the spool slides forward freely on the tube.



OUTER END OF *MODERN* SHOCK-ABSORBING FEED TUBE



REGULAR B & S FEED TUBE

A.S.T.E. NEWS

NEWS OF INTEREST AND ABOUT MEMBERS

Evansville Chartered With Record Membership

THE 73rd AND LARGEST charter group ever admitted to the Society was officially launched May 17, at a dinner meeting in the McCurdy Hotel, Evansville, Ind.

Charter ceremonies for the 115 members comprising the new Evansville Chapter were conducted by Past President Douglas D. Burnside, Plant Superintendent, Consolidated Vultee Aircraft Corp., Nashville, Tenn.

Election and Installation Held

Officers elected at the meeting, and installed by Mr. Burnside, are: Chairman, Howard C. McMillen, Superintendent, Production Engineering, Seeger-Sunbeam Corp.; First Vice-Chairman, Frank J. Hausfeld, Jr., Planning Engineer, International Harvester Co.; Second Vice-Chairman, Harry W. Ferguson, Superintendent, Tool Div., Servel, Inc.; Secretary, Clyde E. Yost, President and General Manager, Ken Standard Corp.; and Treasurer, Walter C. Doebling, President and General Manager, Metal Craft, Inc.

The Nominating Committee, submitting the slate of candidates for office, was composed of: Roy F. Ackerman, Chairman; Harry Protherow and Fred J. Seibenmann.

Mr. Burnside, in an inspirational address, outlined the history and purpose of the Society. Everyone engaged in manufacturing, he said, can use the other fellow's ideas; but until the formation of ASTE, he added, tool engineers had no way of exchanging ideas and methods for mutual benefit in industry.

Harry E. Conrad, Executive Secretary from the National Office at Detroit, also spoke, explaining the activities and operation of the organization.

A rosewood gavel, the gift of an anonymous donor, was presented to the Chapter during the evening.

A. A. Carlson, Vice-President of Hoosier Cardinal Corp., and a charter member of ASTE, served as Chairman Pro-tem before the election of officers. Mr. Carlson, who laid the groundwork for the organization of the Chapter, has been an active member of several other Chapters since joining the Society in 1932.

Also prominent in the preliminary work were Mr. Seibenmann, recently of Tri-Cities Chapter, and Mr. McMillen, the Chairman, who is a Past Chairman of Dayton Chapter.

Manufacturers Cooperate

The formation of the Chapter was actively sponsored by the Evansville Manufacturers and Employers Association. Norman L. Kniese, Secretary-Manager of the Association, headed up the pre-organization activities, securing effective cooperation from management in the various local plants.

Principal industries represented by the membership include: Bucyrus-Erie Co., Evansville Supply Co., Faultless Caster Corp., General Tool and Die Corp., Holsclaw Bros., Inc., Hoosier Cardinal Corp., International Harvester Co., Ken Standard Corp., Metal Craft, Inc., Orr Iron Co., Seeger-Sunbeam Corp., Servel, Inc., Schnacke Mfg. Co., Strippler Tool & Supply Co., and Tri-State Tool and Machine Co.

Guests attending the chartering included visitors from St. Louis, Dayton, Nashville, and Tri-Cities Chapters.

The 73rd ASTE charter was presented to a group of 115 Evansville, Indiana, tool engineers at ceremonies held May 17 in the McCurdy Hotel, Evansville. The new Chapter elected as officers (top, left to right): Howard C. McMillen, Chairman; Frank J. Hausfeld, Jr., First Vice-Chairman; Harry W. Ferguson, Second Vice-Chairman; Clyde E. Yost, Secretary; and Walter C. Doebling, Treasurer.

In This Issue

Committees Plan October Convention at Pittsburgh

Pittsburgh, Pa.—Members of the National Program Committee met with Pittsburgh Chapter officers, May 3, to discuss organizational plans for the ASTE Semi-Annual Meeting to be held here October 10-11-12.

Development of the program will be under the direction of National Program Chairman H. D. Hall and his committee: R. W. Ford, First Vice-Chairman; E. W. Baumgardner, Second Vice-Chairman; Stephen Urban, Secretary; H. E. Linsley, O. W. Winter and F. J. Schmitt. New members of Mr. Hall's committee are: F. E. Doty, Jr., of Houston, and H. R. Shearer of Indianapolis.

Pittsburgh Chapter named Chairman William H. Schott and Past Chairman C. E. J. Brickner as Co-Chairmen of the Host Chapter Committees.

Other Past Chairmen heading up committees include: D. L. Bardes, Accommodations; G. P. Grace, Technical Meeting Arrangements; William Owen, Banquet; J. P. Wiley, Plant Tours; and Gardner Young, Reception.

National Officers attending the meeting were: President A. M. Sargent, First Vice-President W. B. Peirce, Second Vice-President T. P. Orchard, Third Vice-President I. F. Holland, and Executive Secretary H. E. Conrad.

Pittsburgh Chapter officers present were: Mr. Schott, the Chairman; Paul H. Magnus, First Vice-Chairman; Karl Johnson, Secretary; and G. C. Wood, Treasurer. Second Vice-Chairman W. S. Risser, who serves as Secretary to the convention committees, was unable to be present.

Another joint meeting of the convention committees is scheduled for July 12-13 at Pittsburgh.

Feeding Machine Promotes Safety

Grand Rapids, Mich.—James C. Covert, President, Covert Manufacturing Co., Troy, N. Y., read a paper on the "Heyman Semi-Automatic Feeding Machine," at a meeting of Western Michigan Chapter, held April 15 in the Rowe Hotel.

The feeding machine, used to place parts in dies, increases production and promotes safety for the operator, who thus avoids placing his hands between the dies.

At the conclusion of Mr. Covert's talk, E. G. Macaulay, Production Superintendent of the Covert factory, gave details of the precision work necessary in building the machine. He also answered questions concerning its operation and safety features.

Several members reported on the convention and New Era Exposition at Cleveland.

Airs Grinding Problems In Illustrated Lecture

Baltimore, Md. — Problems encountered in the tool room and in mass production were thoroughly discussed by Walter M. Smith, Eastern Salesmanager for Bryant Chucking Grinder Co., Springfield, Vt., and speaker April 3 at a meeting of Baltimore Chapter held in the Engineers Club.

W. M. Smith

Mr. Smith, a forceful speaker, effectively presented the answers to questions confronting engineers and shop men concerned with internal grinding. His lecture and the accompanying film explained the tooling of internal grinding machines for greater accuracy, finer finish and higher production.

About 50 members and guests were present for the dinner, with approximately 65 attending the technical session.

Electronics No Mystery Declares Scientist

Peoria, Ill.—A glass bottle, a tin can, a bent hairpin, and a piece of window screen are about all there is to electronics, members of Peoria Chapter were told at their May 7 dinner meeting.

Translating the much publicized science into terms easily understandable to the layman, Gordon Volkenant, Coordinator of New Product Research for the Minneapolis-Honeywell Regulator Co., explained and demonstrated that "electronics offers a method of doing in a simple manner—a very simple manner —things that otherwise would be difficult or often impossible."

Speaking at a table crowded with

Electronics is simple as explained by Gordon Volkenant, Coordinator of New Product Research for Minneapolis-Honeywell Regulator Co., Minneapolis. Mr. Volkenant (left) tells George Walters, Peoria Chapter Technical Chairman, how tiny tubes, similar to the one he is holding, make up complete sending and receiving set in nose of proximity shell held by Mr. Volkenant.

large and small tubes, sirens that blow when approached, whirling gyroscopes, a bombsight and a model airplane, Mr. Volkenant told the members how electronics played a hitherto unpublicized, but important, part in the United Nations' bombing program.

The electronic Autopilot, which his company developed for all precision bombing aircraft, had its beginnings in a thermostat, he explained, while radar, automatic engine control, and many of the other "amazing" weapons of victory were nothing more than specialized variations of control devices developed by industry long before Pearl Harbor.

Speaking well over his scheduled time at the insistence of his audience, the young engineer continually stressed the simplicity of the new science and criticized those who attempt to surround the electron with an aura of mystery.

Discovered in Blackened Bulbs

"The science of electronics began about 30 years ago," he continued, "when someone became curious to know just what happens to electric light bulbs as they age and burn out.

"Why does the inside of the bulb blacken with age?" he asked, and then explained that as the little tungsten filament within the bulb disintegrates it throws off tiny particles that form the blackening.

"Each particle is potent with a millionth of a fly-power of energy capable of developing into one elephant-power," Mr. Volkenant added, and, "each tiny particle or ion carries with it a charge of electricity—hence the term 'electron' which means simply a charged ion of metal."

The Autopilot, he said, was developed to transform a bomber into a "steady platform." Through its myriads of electronic circuits it is capable of making more than 300 flight corrections a minute, or more than five a second. It was responsible for saving more than 10,000 lives and 1,000 airplanes in the Eighth Air Force alone.

Electronics is just another word for control, according to the scientist who has studied in 13 European countries as well as at American universities. Today the circuits of the Autopilot, the blind bombing devices, and some of the other weapons made for the armed services are being modified for peacetime living, he concluded.

Baltimore Chapter's new Executive Committee has brief session before April 3 Chapter meeting in the Engineers Club. Seated (left to right): Clarence Hand, Treasurer; Thomas Burke, Second Vice-Chairman; William D. Winger, Sr., Chairman; Kurt H. George, First Vice-Chairman; and Harold C. Suiter, Secretary. Standing, Committee Chairmen: George J. Stevens, Entertainment; Henry H. Roschen, Standards; James Francey, Education; Howard C. Will, Constitution and By-Laws; George Exley, Public Relations; Nils H. Lou, Editorial; and Stuart H. McCaughey, Membership.

Golden Rule Pays Returns In Employee Co-operation

Indianapolis, Ind.—Some 200 members, guests and executives attended Executives Night, held April 2 by Indianapolis Chapter at the Lincoln Hotel.

A short business meeting followed the dinner. Chairman D. R. Smith, in welcoming the honored guests, asked them to stand and be recognized.

First Vice-Chairman John Horton spoke on the purpose of Executives Night. Historian H. D. Hiatt reviewed the founding and growth of Indianapolis Chapter, and George Duncan reported on the New Era Exposition.

Mayor Tyndall spoke briefly on the problems of a public official, urging that organizations like ASTE take more interest in government and public welfare.

Principal address of the evening was given by Harry Coopland, Special Representative, Jack & Heintz, Inc., Cleveland, Ohio, whose subject was "Seeing is Believing," the saga of Jack & Heintz, referred to by Mr. Coopland as "The House of the Golden Rule."

He described the well-known labor policies of this concern which achieved an astounding war production at lowered costs in the face of high wages and many employee privileges and services.

In summarizing, Mr. Coopland said, "Give a man security, good pay, good working conditions, humanitarian treatment, and success will follow just as surely as night follows day. As a parting shot to businessmen and industrialists, nobody has a monopoly on the Golden Rule. It's free to anyone who cares to practice it."

Crush Dressed Wheels Sharper, Cooler

Worcester, Mass.—A meeting of unusual interest was held at Putnam and Thurston Restaurant on May 7 when Worcester Chapter heard Carl G. Linxweiler and R. Y. Moss of the Sheffield Corp., Dayton, Ohio. The meeting was the largest Chapter turn-out on record, with 197 at dinner and an additional 50 for the subsequent technical session.

The speakers' discussion of the developments and procedures for crush dressing brought out several interesting points, such as: that crush dressed wheels are sharper and have a cooler cutting action, and that intricate forms can be accurately and economically dressed.

During the business meeting preceding the technical talks, National Treasurer Victor H. Ericson and Director William W. Young spoke briefly. Many visitors were present from surrounding communities, including a delegation from Twin States Chapter.

New Haven Chapter Officers and Committeemen

Plans for the '46-'47 season are launched at roundtable of New Haven Chapter Executive Committee. Seated (left to right): John H. Alton, Public Relations; Joseph Benson, Membership; Alton V. Pollard, Second Vice-Chairman; Theodore D. O'Connor, Treasurer; Frank Shute, Chairman; Ray E. Gifford, First Vice-Chairman; Floyd W. Braynard, Secretary; and Gerard T. Schoeller, Attendance. Standing: John F. Sargent, Retiring Chairman; Fred J. Dawless and M. J. Weldon, Advisory; Mr. Brutenbach, a guest; and William T. Brown, Entertainment. Editorial Chairman R. N. Strickland is the photographer.

Jahnke Delineates Lubricant Making

Boston, Mass.—First Boston Chapter meeting of the new season was held April 11 at Schrafft's restaurant.

L. F. Jahnke of Socony-Vacuum Oil Co., Inc., was the technical speaker. Mr. Jahnke's talk, highlighted by a demonstration of ingenious models of his own devising, dealt with the manufacture of lubricants for industries served by machine tools and machinery of all sorts.

Edward J. Barry, of USES, explained the training program outlined by the Government under its new policy of "On the Job Training for Veterans."

Continuing Boston Chapter's program of "gadget" talks, Harold L. Seekins, Methods Engineer of General Electric Co. River Works, read a paper on "Vibration Tracer for a Hand Duplicator." His talk, illustrated with slides, concerned the use of sound for tracer milling on thin sections, particularly in inaccessible places.

Open Discussion Centers On Gear Teeth Shaving

Bridgeport, Conn. — Fairfield County Chapter held their monthly dinner meeting at the Algonquin Club, April 3, with fifty members in attendance.

Speaker of the evening was A. R. Tobin, Field Engineer for the Fellows Gear Shaper Co. of Springfield, Vt. His subject was "The Art of Generating with a Reciprocating Tool."

A two-reel motion picture was shown, emphasizing the salient points in the design and construction of gear teeth, and techniques in gear shaping and shaving.

Shaving of heat-treated gear teeth was discussed in length by Mr. Tobin in the ensuing question and answer period.

Urges Care in Machining Of Stainless Steels

Baltimore, Md.—"Machining of Stainless Steels with Carbides" was presented in an interesting manner by George J. Stevens, Machining Engineer of Rustless Iron and Steel Div., American Rolling Mill Co., at a meeting of Baltimore Chapter held May 1 in the Engineers Club.

Because of the higher mechanical properties of stainless steel, Mr. Stevens pointed out, care must be given to the machining techniques employed. In high production machines, such as single- and multiple-spindle automatics designed principally for brass, aluminum, and screw stock, production on stainless steel should not exceed 75% of the rated capacity of the equipment.

By observing this rule, he said, it is possible in many instances to employ carbide tools, because of greater rigidity in the tool set-up. Variations occurring between the several grades of carbides were illustrated.

Cites Examples

Mr. Stevens concluded his talk with several illustrations of problems encountered in the machining of stainless steel, and their solutions.

George E. Linnert, Welding Engineer of the Rustless Company, spoke briefly on the application of gas-shielded arc welding. His discussion included basic properties and advantages of the process, and type of equipment used.

Specifically, he mentioned an operation involving the welding of a part machined from Type 303 stainless to a tube of Type 304 stainless, where it was necessary to minimize the heat effect. The operation was particularly adapted to this method of welding, he explained.

Indianapolis Chapter officers and guest speakers visit during April 2 Executives Night dinner in the Lincoln Hotel. Principal speaker was Harry Coopland, Jack & Heintz Special Representative, who discussed company employee policies. Seated, in both views of the speakers' table, are (left to right): R. F. Krause, Treasurer; Hayden Shearer, National Director; M. Green, Indianapolis Chamber of Commerce; H. D. ("Pop") Hiatt, Historian; Mayor Tyndall; D. R. Smith, Chairman; Mr. Coopland; John Horton, First Vice-Chairman; Harry Boese, Constitution and By-Laws Chairman; Joseph Huser, Membership Advisory Chairman; C. M. Wetzel, Second Vice-Chairman; and H. W. Curfman, Secretary. Function was attended by 200 members and executives.

Millson Sees Wide Use of Aluminum Impact Extruding

Montreal, Que. — How bauxite ore, brought by sea from British Guiana, is unloaded at Saguenay, refined at Arvida, Quebec, fabricated at Kingston, and cast at Toronto, Ontario, was related by J. C. Millson of the Aluminum Company of Canada, Ltd., in an address before Montreal Chapter, April 17.

In emphasizing the importance of aluminum to Canada, Mr. Millson named benefits derived from the huge Shipshaw Power development.

Continuing, Mr. Millson described the wide variety of aluminum alloys available, their many applications in industry, and the effects of various alloying elements on machineability. His remarks were accompanied by slides showing the tools used, with emphasis on clearance and rake angles and their similarity to angles used in machining hardwoods.

Greater Chip Clearance Needed

The speaker also stressed the necessity for greater chip clearance at cutting speeds which may be as much as ten times those of steel. This necessitates the use of fewer teeth on multi-tooth cutters, such as for milling. In some cases, milling cutters with only two teeth are required for highest efficiency, he pointed out.

During the question period following this extremely interesting address, impact extrusions and the spinning of aluminum alloys were discussed. Mr. Millson's description of the former indicated that the process will have a very wide application in industry.

He urged thorough investigation of possible applications of this process by all progressive tool engineers. By its use, deep drawing is simplified to the stage where only one operation is necessary on even the deepest draws in varied shapes, he added. It is particularly adapted to long cylinders closed at one end, boxes, cartridges and ribbed containers.

"Poor finishes on metal spinnings," Mr. Millson observed, "are due to a variety of causes, chiefly—using the wrong alloys, improper tooling, defective heat treatment and lack of experience on the part of the operator."

The second feature, "High Speed Motion Picture Photography," was presented by V. O. Marquez, Public Relations Manager for Northern Electric Co., Montreal, who held the interest of the audience with an extensive knowledge of his subject and his straightforward and effective manner of making simple an apparently complicated technical instrument.

In his opening remarks, Mr. Marquez defined the theory of the magnification of time in this branch of photography where the film is exposed at high speed and projected at normal speed. He went on to explain "slow motion" and the difficulties encountered in developing the high speed camera through the synchronization limitations of the prevailing shutter mechanism.

Mr. Marquez showed how a revolving prism produced the synchronization essential in high speed photography and the ultimate development of the "Fastax" camera which takes photographs at the amazing rate of 40,000 pictures per second.

This is accomplished by the use of a take-off reel on which the film is wound, and a take-up reel to rewind it after the images have been registered, both driven by individual motors.

The many-sided prism is geared to the reels and revolves in synchronization with the feed of the film. Through polarization of light, images are projected upon the sensitized film at ultra high speed, eliminating the necessity for shutters.

Shows High Speed Pictures

A 16mm. film, portraying the development of the "Fastax" camera and some of its applications, illustrated Mr. Marquez' address. The production also gave entrancing views of the world of action which occurs in such a simple act as the falling of a drop of milk into a bowl. Seen in high speed pictures, the action following the contact resembles the eruption of a volcano or the formation of a water-spout. Operation of the cam mechanism on a dial telephone was also revealed at a time magnification of 250 to 1.

In closing, Mr. Marquez stated that even greater magnifications are possible with eight-sided prisms replacing the four-sided one demonstrated.

At the conclusion of Mr. Marquez' talk, National Secretary R. B. Douglas commented on the general industrial and engineering applications of high speed photography in studying motion where the human eye or the ordinary camera is inadequate.

During the evening Mr. Douglas, Chairman W. F. Stewart and Membership Chairman W. S. MacLaren, reported on the Annual Meeting and New Era Exposition at Cleveland.

Fred J. Schmitt, First Vice-Chairman of Chicago Chapter, introduces O. J. Seeds and Walter C. Smith, of Cerro de Pasco Copper Corp., who described industrial applications of low-melting point bismuth alloys, at April 1 meeting. At speakers' table (left to right) are: Messrs. Seeds, Smith and Schmitt, Ben C. Brosheer, Public Relations Chairman; Frank M. Kincaid, Standards Chairman; and Anton Schwister, Treasurer. Chairman Clare Bryan, ill in a hospital, was unable to be present.

Production Broaching Described by Iversen

Decatur, Ill.—"Broaches and Broaching" was the technical topic discussed at the April 16 dinner meeting of Decatur Chapter, held in the Decatur Club.

Norman Iversen

Norman Iversen, Chief Engineer of the Michigan Broach Co., Detroit, and speaker of the evening, gave an excellent presentation of new developments in broaching. He explained and contrasted standard types of broaches and multiple-piece broaches used in production runs.

A film and display of parts complemented Mr. Iversen's talk.

The program was enjoyed by an attendance of 50 members and guests.

B-24 Production Problem Shown in Motion Pictures

Atlanta, Ga.—May meeting of Atlanta Chapter was held on the 1st in the Banquet Hall of Georgia School of Technology.

Through courtesy of the Ford Motor Co., two reels of motion pictures were shown. The first illustrated some of the unique tooling and production methods used in Ford plants, and the rigorous inspection and tests that individual parts and finished automobiles undergo.

The story of Willow Run, narrated in the second production, revealed many of the almost insurmountable difficulties that had to be overcome in order to mass-produce the Liberator Bomber at the rate of one per hour.

George Brown, Secretary, and Delegate to the Annual Meeting at Cleveland, gave a brief report on the convention and highlights of the New Era Exposition.

Bismuth-Base Alloys Have Many Industrial Uses

Chicago, Ill. — Bismuth-base alloys, some of which can be melted in hot water, found many industrial applications on war production operations. Characteristics of these alloys and their industrial uses were discussed at the April 1 meeting of Chicago Chapter by Walter C. Smith, Chief Metallurgist, and O. J. Seeds, Engineer, of the Cerro de Pasco Copper Corp.

In the early twenties, the speakers stated, bismuth found its principal use in various pharmaceuticals, but today 75% of the available supply of this element is going into industrial alloys. These alloys are used for anchoring punches in dies, repairing broken or cracked dies, bending thin-walled tubings and extruded shapes, and for metallizing wood patterns and core boxes.

A relatively recent development is the employment of bismuth alloys in electro-forming complicated shapes from a number of metals. This process makes possible the reproduction of original models to close tolerances, according to the speakers.

Tests Prove Cutting Oils Affect Power Input

Philadelphia, Pa.—Two hundred and fifty members and guests of Philadelphia Chapter heard Alan B. Myler of the Sun Oil Co., in a technical address at a recent meeting in the Engineers Club.

Mr. Myler's subject, "An Evaluation of Heavy Duty Cutting Oils," was a masterly presentation of the painstaking efforts put forth by his company's laboratory to arrive at fair, comparative oil tests.

Some oils, he admitted, although theoretically of the best quality, fail in tests duplicating actual working conditions. Standard samples, such as ¾" x 10" threading studs, are tested in groups of 100 of the same steel.

All factors of importance, Mr. Myler added, are recorded such as power input, temperatures of the parts and oil, and condition of the finish. Sometimes an increase in power is required after about 20 pieces, the commonly-known "breaking-in" period.

Experiments consistently demonstrate, the speaker stressed, that when good cutting oil is used, other conditions being equal, power reaches a peak and remains constant; but with poor oil, power input wavers.

Walter M. Smith, Eastern Sales Manager of the Bryant Chucking Grinder Co., spoke on "Tooling for Better Internal Grinding," explaining the advantage of the diaphragm chuck.

Mr. Smith showed technicolor motion pictures demonstrating points emphasized in his lecture.

Highlights of the film included a very rapid method of dressing a wheel from a contour controlling the work feed, and a clever arrangement of feeding into the chuck.

Prior to the speaking program, retiring Chairman John W. Noble swore into office the 1946 Chapter executives. Officers installed were: Howard W. Gross, Chairman; Arthur R. Diamond, First Vice-Chairman; Samuel R. Boyer, Second Vice-Chairman; W. Warren Cady, Secretary; and Harold I. Holden, Treasurer.

Editorial Chairmen

Picnics, outings and other summer activities of your Chapter should be reported to The Tool Engineer. Action photos help tell your story.

Members and guests at Chicago's "Ladies Night" meeting came with their wives to hear about the benefits of low-temperature equipment and to enjoy the antics of night club celebrities. Right: Highlight of the fun was performance of Marvin Himmel (center) ably assisted by two members.

Sub-Zero Processes "Ladies Night" Topic

Chicago, Ill.—Three hundred members and guests of Chicago Chapter met at the Furniture Club of America on May 6 for the Chapter's annual "Ladies Night" entertainment.

Following dinner, C. T. Redding and R. V. Newbell of Deepfreeze Div., Motor Products Corp., discussed the benefits of sub-zero temperature equipment in industry and in the home.

Mr. Redding described, in general terms, the treating of steel by sub-zero freezing, outlining the effects of heat and cold on the structure of steel and the benefits obtained from transforming auscenitic structures into martensitic structures through subjection of the metal parts to a temperature of minus 120° F.

For the benefit of the ladies present, Mr. Newbell discussed the Deepfreeze method of preserving foods of every description for better eating and better living. He told how complete meals can be prepared ahead of time and frozen until needed, as well as how leftovers can be saved efficiently.

At the conclusion of his talk, an outstanding array of night club celebrities entertained those present.

Officers Installed

Pontiac, Mich. — New officers of Pontiac Chapter were installed at a recent meeting in the V.F.W. Clubroom with Past President T. B. Carpenter conducting the installation.

Those sworn into office include George F. Bryan, Chairman; Harry Jeremy, First Vice-Chairman; Claude E. Osborne, Second Vice-Chairman; Albert J. Rhodes, Secretary; Lloyd W. Pardee, Treasurer; Charles F. Staples, Delegate; and N. E. Maytag, Alternate.

Following the induction ceremony J. T. Welch of the Sheffield Corp., Dayton, Ohio, gave an illustrated lecture on "Crushed Wheel Grinding."

Technical speakers at Philadelphia Chapter's installation meeting were Alan B. Myler (top) of the Sun Oil Co., and Walter M. Smith (below) of Bryant Chucking Grinder Co. Right: Retiring Chairman John W. Noble charges Second Vice-Chairman Samuel R. Boyer with the conscientious performance of his duties, during annual installation of officers. Left to right: Harold I. Holden, Treasurer; W. Warren Cady, Secretary; Mr. Boyer, A. R. Diamond, First Vice-Chairman; H. W. Gross, Chairman; and Mr. Noble.

Situations Wanted

CANADIAN EXECUTIVE—Many years of practical experience with Canadian firms on machine and tool design, jigs and fixtures. Have served as Chief Inspector, Master Mechanic, Plant Engineer, Superintendent and Plant Manager respectively. Prefer Canadian affiliation. Graduate Mechanical Engineer. Write Box G, American Society of Tool Engineers, 1666 Penobscot Bldg., Detroit 26, Mich.

DESIGNER—Navy veteran, 29, experienced experimental design and development of lighter-than-air projects; tool design—small jigs and fixtures, aircraft assembly jigs and welding jigs, chucks; bus body and sheet metal design. Have also worked on fractional horsepower electric motors, and research. Education: 3 years engineering college. Married, family, prefer Northern Ohio location. Address inquiries to Box E, American Society of Tool Engineers, 1666 Penobscot Bldg., Detroit 26, Mich.

PLANNING ENGINEER—20 years' experience: Tool designing and tool manufacture, executive experience. Highest references. Educated and trained in England; conversant with modern types of aircraft and production methods. Age 39. Would prefer Northern States or Canada. Address reply to Box D, American Society of Tool Engineers, 1666 Penobscot Bldg., Detroit 26, Mich.

PROCESS ENGINEER — Age 41 — well rounded technical education, good shop background with experience in operation sheet layout, tool design, purchasing, engineering sales and supervision. Graduate training Industrial Management, Marketing, Law, Powder Metallurgy-Research and Engine Design. Member ASM, ASTE, ASTM. Excellent references. Desires position as sales engineer in machinery, tool or engine field. Prefers Penna., N. Y., N. J. or Conn. area. Arrangement must provide earnings of $6000.00 minimum yearly. Write Box C, American Society of Tool Engineers, 1666 Penobscot Bldg., Detroit 26, Mich.

TOOL ENGINEER—Graduate Mechanical Engineer with 9 years design and production experience, including 4½ years of well-rounded tool design training. Address Box F, American Society of Tool Engineers, 1666 Penobscot Bldg., Detroit, Mich.

G. B. Berlien (left), Heat Treatment Engineer for the Industrial Steel Treating Co., Oakland, Calif., lectures on "The Relation Between Hardening Ability and Heat Treating" at Installation Night meeting of Golden Gate Chapter. Center view shows one of the dinner tables. At right Chairman Edward J. Raves reads his committee appointments while other newly-installed officers look on. Left to right: Henry Hagedorn, Treasurer; Mr. Raves, Floyd V. Snodgrass, First Vice-Chairman; and Florindo Viti, Secretary. Ernest C. Holden, Second Vice-Chairman, was unable to be present at the meeting.

Balancing Machines Check Fifty-Ton Rotors

Minneapolis, Minn. — Installation of new officers for the coming season highlighted the business session of a recent Twin City Chapter meeting held in the Lodge Room of the Covered Wagon Cafe.

F. R. Bokorney

Past Chairman George Wise, a charter member and active Society worker, inducted into office: John A. Harrington, Chairman; Clifford V. Lofdahl, First Vice-Chairman; Raymond L. Martin, Second Vice-Chairman; and Harold D. Sullivan, Secretary-Treasurer. In closing Mr. Wise commended the retiring officers for the splendid and efficient performance of their duties.

Explains Types of Unbalance

Technical speaker was F. R. Bokorney, Sales Manager of the Balancing Machine Div., Gisholt Machine Co., Madison, Wis., who spoke on the subject, "Recent Developments in Balancing Machines."

Mr. Bokorney mentioned numerous mechanical devices used daily and operated at high speeds. The presence of vibration, he pointed out, would be objectionable to the user.

Using slides, he illustrated the two types of unbalance—static and dynamic. Simple setups were shown, as well as more complex units capable of making an accurate check and transmitting the readings to a drilling head which would remove the necessary material from the flanges of the armature or engine crankshaft.

These balancing machines, he continued, are capable of detecting one-quarter of a ten-thousand ounce inch of unbalance. Special machines, Mr. Bokorney added, have been built to handle a 200" rotor weighing 100,000 pounds.

In conclusion, the speaker said that design trends in balancing machines were toward simplicity and rapid operation, together with corrective equipment integrated with the checking unit.

Hardenability a Factor In Specifying Steel

San Francisco, Calif.—"The Relation Between Hardening Ability and Heat Treating" was explained to Golden Gate Chapter members by G. B. Berlien, Heat Treatment Engineer, Industrial Steel Treating Co., Oakland, speaking before a recent meeting at the Engineers Club.

Mr. Berlien advocated consideration of hardenability factors in future steel specifications for more uniform results by steel purchasers. "In specifying, engineers should use those qualities in steel which are suitable for the job at hand and refrain from 'over designing'," he said.

Past Chairman Walter Kassebohm conducted the installation of Chapter officers: Edward J. Raves, Chairman; Floyd V. Snodgrass, First Vice-Chairman; Ernest C. Holden, Second Vice-Chairman; Florindo Viti, Secretary; and Henry Hagedorn, Treasurer.

Mr. Raves, the new Chairman, announced the appointment of the following Committee Chairmen: Henry Hagedorn, Constitution and By-Laws; Floyd V. Snodgrass, Program; Louis Talamini, Standards; Lester P. Martin, Membership; Lawrence H. Cook, Editorial; Emerson V. Denham, Education; Al Minetti, Industrial Relations; Ernest C. Holden, Public Relations; DeWitt M. Grimm, Entertainment; Karl L. Bues and Harold Wolpman, Advisory.

New Broaching Techniques For Efficient Production

St. Louis, Mo. — "Making Things Quicker, Cheaper and Better by Broaching" was explained to St. Louis Chapter members by Kenneth N. Macomber, Chief Field Engineer, La Pointe Machine Tool Co., Hudson, Mass., in a lecture at the Melbourne Hotel, April 18.

K. N. Macomber

Mr. Macomber's address was well-illustrated with color motion pictures telling the history of broaching and the manufacture and uses of such multiple cutting tools.

The film showed actual applications such as in the breach block of big guns made at Springfield Arsenal, Colt Automatic barrels, Stevens-Walden open end wrenches, and similar production jobs using standard broaching machines with special tooling.

At the close of the meeting, several members gathered around Mr. Macomber to discuss their individual broaching problems.

Before the technical session, Edgar J. Mothershead, Editor of Western Press Association, gave an illuminating talk on "The American Indian."

Wearing an Indian war bonnet, Mr. Mothershead narrated Indian hereditary characteristics, history, customs, and place names derived from the language of the aborigines. Humorous anecdotes, concerning his Indian grandfather, enlivened the speaker's remarks.

Chairman J. J. Demuth presented retiring Chairman Willis Ehrhardt with a bronze ASTE emblem mounted on a walnut wall plaque.

Plans for an extensiye social and technical program were announced by the new administration.

Twin City's new officers were installed during a Chapter meeting at the Covered Wagon Cafe, Minneapolis. They are (left to right): Harold D. Sullivan, Secretary-Treasurer; Clifford V. Lofdahl, First Vice-Chairman; John A. Harrington, Chairman; and Raymond L. Martin, Second Vice-Chairman.

Coming Meetings

CLEVELAND—July 12, Annual Summer Golf Party and Dinner, Pine Ridge Country Club, Johnnycake Ridge, State Route 84, Wickliffe.

DAYTON—July 10, Annual Fish Fry.

MILWAUKEE—June 22, Annual Dinner Dance, Elks Club.

PITTSBURGH—June 22, Good Fellowship Picnic, Daniels Farm, McKnight Road, Pittsburgh.

Charter Members Feted At Tenth Anniversary

Milwaukee, Wis.—Tenth Anniversary of the chartering of Milwaukee Chapter was celebrated April 4 at a meeting in the Elks Club.

Charter members recognized in Harold Heywood's "old timer's speech" included: W. M. James, W. A. Schaefer, A. J. Seeger, A. W. Schaefer, R. A. Radtke, N. V. Husting, R. P. Bliss, A. W. Johnson, A. C. Gudert, R. M. Costello, C. S. Jorgensen, Elmer White and L. J. Radermacher. Mr. Heywood also is one of the original charter group.

Program Chairman Paul Butzin introduced the technical speakers, Lester Birbaum and Ray Buettner of the Milwaukee Stamping Co.

Mr. Buettner explained various methods employed in making stampings, special forms and shearing—all related to phases of production stamping. Type and design of dies was also touched on and described.

Emphasis was laid on points to help designers save time, labor, material and trouble.

Mr. Birbaum conducted an open forum discussion, answering the members' questions on special or individual problems.

At the conclusion of their program, the film, "Highway to Alaska," was screened. An Allis-Chalmers production, the motion picture shows before and after scenes of the construction of the Alcan Highway.

Wet Belt Grinding Saves Labor, Stock

New York City—Frazier A. Hurd, Mechanical Engineer, Porter-Cable Machine Co., Syracuse, N. Y., addressed Greater New York Chapter at a dinner meeting held April 1 in the Hotel New Yorker. His subject was "Wet Belt Precision Machining."

F. A. Hurd

Mr. Hurd traced the development of wet belt machining, supplementing his lecture with slides showing actual applications of the process.

Advantages of this method, as pointed out by Mr. Hurd, are: 75% saving in material allowed for machining, less stock removal time, elimination of dust and heat, flexibility in following contours and machining small parts, and longer abrasive life.

Before the technical session a fishing film was shown. Refreshments were served at the close of the meeting.

Fourteen charter members of Milwaukee Chapter attended Tenth Anniversary observance April 4 at the Elks Club. Standing (left to right): W. M. James, W. A. Schaefer, A. J. Seeger, A. W. Schaefer, R. A. Radtke, N. V. Husting, R. P. Bliss and A. W. Johnson. Seated: H. L. Heywood, A. C. Gudert, R. M. Costello and C. S Jorgensen.
Two other original members of Milwaukee Chapter, L. J. Radermacher and Elmer White, also attended commemoration, but were not present when photograph was taken.

G.E. Executive Urges OPA To Stimulate Production

Hartford, Conn. — Addressing about 375 members of Hartford Chapter during a dinner meeting April 1 at the Hedges in New Britain, David C. Prince, Vice-President of General Electric Co., expressed mistrust of the theory of mature economy becoming effective in this age.

He declared that there is no danger of the present generation of men working themselves out of jobs, with world shortages in nearly everything required for modern living. Markets, he said, are available for many products and the nation is even short of factories, machines and tools with which to make them.

Price Controls Vital

Discussing price ceilings, Mr. Prince said, "In spite of the drive against continuance of price ceilings, it is believed that these are the only available check on a violent inflation, and that if price ceilings are established to promote production of most needed goods, they will provide a very valuable safeguard against a violent boom followed by an equally violent reaction."

Removal of price controls, he said, would result in chaotic conditions. Prices would go out of sight, but if OPA does not allow prices to cover costs, production will be affected. He agreed that a lid should be placed on prices, but said it should be high enough to permit profits and encourage production.

"If industry produces only goods on which a profit can be made it will be confronted by a lack of markets because it will run out of buyers," he said. "A balanced economy is the only solution to the situation."

Earlier in his talk, Mr. Prince said, "Now that the war is over, it seems appropriate to review some of the preparations made for winning the peace.

"As long ago as 1941, a survey was made of postwar potentialities, selecting 1946 as the year and estimating 57 million people as the number available for employment. These estimates could be realized this year except for the current disruption due to strikes. The ravages of war have dissipated the oversaving which in the eyes of the mature economy advocates, barred high level employment.

CED Research

"The general composition of our potential national product," Mr. Prince continued, "has been checked in 'Markets After the War' by S. Morris Livingston of the Bureau of Foreign and Domestic Commerce, and again in 'American Industry Looks Ahead,' both published by the Committee for Economic Development. We might now proceed with the realization of these forecasts, except for labor difficulties and those restrictions of OPA which hold prices below costs."

The speaker added that overall estimates of gross national product are projected through the year 1950, indicating a potential level by that time of 190 billions. Realization of these goals depends upon concerted action by those who have the production know-how, who must also assume responsibility for persuading the country as a whole to accept the program and carry it out, he concluded.

Edmond Morancey, Chapter Chairman and master of ceremonies, announced that the event was the second annual "New Britain Night" and that New Britain men comprise 20% of the Chapter membership.

Greater New York members hear Frazier A. Hurd, of Porter-Cable Machine Co., tell newest grinding, surfacing and stock removal methods with belt grinding machinery. Mr. Hurd was speaker at April 1 meeting in Hotel New Yorker. He used slide illustrations of practical applications.

Grimshaw and Kells Give Steel Treating Talks

Toledo, Ohio—Leonard C. Grimshaw, Chief Metallurgist, and Ray P. Kells, Chief Service Engineer of Latrobe Electric Steel Co., collaborated in a presentation of "The Selection and Heat Treatment of Tool and Die Steels" at Toledo Chapter's April 3 meeting.

Mr. Grimshaw outlined the basic analysis of familiar alloy steels, reviewing the history of the development of alloys to meet specific requirements of the steel industry. His lecture was well illustrated with slides showing the heat treatment of various tools and dies.

R. P. Kells

L. C. Grimshaw

The subsequent question and answer period was capably conducted by Mr. Kells whose background includes years of experience in the development of alloys and the newer molybdenum steels.

"New Developments in Cutting Oils, Drawing Compounds and Heat Treating Materials," were discussed by J. E. McElgin of the E. F. Houghton Co.

"Gas Bugs" Entertained At Father and Son Night

Rockford, Ill. — Annual Father and Son Night was held May 2 by Rockford Chapter at the East Senior High School.

The members had as their guests the "Gas Bugs," a group of young Rockford boys who make and fly gas model airplanes.

Dinner was served in the high school cafeteria, followed by motion pictures in the auditorium. The films, "The Land Pays Off," and "Making of a Shooter," described the conservation and restocking of game and safety rules for hunting.

Later a gas model demonstration was given in the high school gymnasium by the "Gas Bugs."

Classifies Die Steels For Major Applications

Rochester, N. Y.—Dr. Gordon M. Butler, Jr., Associate Director of Research, Allegheny Ludlum Steel Corp., addressed the April 17 technical session held by Rochester Chapter in Rochester Institute of Technology. Dr. Butler's subject was "Selection of Cold-Work Die Steels."

His talk was planned especially for the man who does not have an extensive knowledge of die steel metallurgy. He classified die steels, according to their characteristics, into eight different types and three general groupings covering major die steel applications.

These included pressing, blanking, forming, punching and coining operations with metals ranging from water-hardening, straight carbon and carbon vanadium steels, oil-hardening and air-hardening steels, up through high carbon, high chromium materials.

Depth of hardening was discussed and the relative properties of various grades of cold-work die steels were compared for requirements in shallow, medium and deep hardening.

Dr. Butler also presented slides and motion pictures illustrating the manufacture of lamination dies and micro-timing. These film studies of cutting tool action were produced with an ultra high speed camera operating at the rate of 4000 frames per second.

This eager group of Rochester members lingers for further discussion of cold-work die steels with Dr. Gordon M. Butler, Jr., of Allegheny Ludlum Steel Corp., speaker at April 17 meeting. Left to right: Chairman Charles Seely, Dr. Butler, Past Chairman Earle De Bisschop (back to camera), George Codd, Editorial Committeeman; and Past Chairman Chauncey Newton.

During the evening Past Chairman Earle DeBisschop, Chapter Delegate to the Annual Meeting, reported on the recent House of Delegates Meeting in Cleveland.

High Frequency Units Reduce Heating Costs

Toronto, Ont.—Describing high frequency heating units and their applications to industry, Otto Weitmann, Vice-President, Lepel High Frequency Laboratories, New York City, said, in an address April 8 before Toronto Chapter, "While these units are not a cure-all for all heating problems, amazing economies on specific applications can be effected by their use."

Otto Weitmann

Giving a brief outline of the history and development of induction heating, the speaker, using diagrams, showed and explained in detail the units, their operation, and how a novice could perform intricate hardening operations with a minimum of instruction.

Time Cycles Controlled

Differential hardening, where various areas of the part hardened showed different Rockwell readings, created considerable interest. Controlled time cycles, to insure uniform heating, proved that efficient and exact performance on many components is the unit's outstanding feature.

A variety of applications was ably demonstrated by means of sound-on-film. Gear teeth hardening, intricate silver soldering, and the brazing of tungsten carbide tips were shown and explained.

During the question period, Toronto Tool Engineers were made aware of the disadvantages of the city's being on 25-cycle rather than the standard 60-cycle current. Mr. Weitmann described auxiliary equipment necessary to convert the units for capable performance.

L. M. Jardine, First Vice-Chairman, occupied the chair in the absence of Walter Appleton who was attending the Annual Meeting in Cleveland with a delegation of Chapter members.

Installation Audience Hears Hydraulics Talk

Peoria, Ill.—One hundred and sixty-five members and friends of Peoria Chapter gathered at the American Legion Hall on April 2 to hear a three-point program.

Installation of the following officers was one of the outstanding events: C. B. Hartsock, Chairman; R. C. Kolb, First Vice-Chairman; R. B. Jones, Second Vice-Chairman; W. J. Peters, Treasurer; and W. A. Pettitt, Secretary.

In an interesting coffee talk, C. N. Bolton of Peoria Better Business Bureau gave some examples of schemes and rackets exposed by his agency.

P. G. Griebel, Technical Chairman, introduced A. B. Riddiford, Jr., Hydraulic Engineer for the John S. Barnes Co., who spoke on "Practical Application of Hydraulics on Machine Tools and Fixtures."

Mr. Riddiford explained simple circuits, the application of standard units to simple circuits, and the application of standard units and simple circuits to a multi-operation machine with electrically controlled sequence.

Peoria Chapter officers were installed at April 2 meeting. Seated (left to right) are: C. B. Hartsock, Chairman; and R. C. Kolb, First Vice-Chairman. Standing (in same order): R. B. Jones, Second Vice-Chairman; W. J. Peters, Treasurer; and W. A. Pettitt, Secretary. Right: A. B. Riddiford, Jr., (left) of John S. Barnes Corp., Rockford, and P. G. Griebel, Technical Chairman, chat about hydraulics. Mr. Riddiford discussed this subject in his address before the Chapter.

I.P.E. Presents Replica Of Coat of Arms

A framed reproduction of this Coat of Arms of the Institution of Production Engineers, Great Britain, was presented to ASTE at the Society's Annual Dinner in Cleveland, by E. W. Hancock, Section President. The heraldic device is executed in red, gold and black.

A significant feature of the crest is the Geneva wheel, held in the forelegs of the bull and typifying multiple-machine production. The squared portion of the shield above the red ground symbolizes control by measurement, while the section of the clock face at the base of the shield symbolizes time control.

The hand stands for the human element, the torch for learning, and the wings for progress. The gold in the shield symbolizes the wealth created by production engineering. In the scroll below the shield is the motto, "Vires Acquirit Eundo," a quotation from Virgil freely translated as "Forging Ahead."

Crush Dressing Efficient For Intricate Forming

Erie, Pa.—April meeting of Erie Chapter was held in the Community Center of the General Electric Erie Works.

J. T. Welch

After dinner, a short business session was held to elect a Second Vice-Chairman, Matthew Hetzel being chosen for the office.

Before presenting the speaker of the evening, Chairman Harold W. Hagle introduced Walter Greenleaf of Pittsburgh Chapter and visitors from the McCrosky Tool Corp., Meadville, Pa., MacErie Manufacturing Co., Skinner Engine Co., Burke Electric Co., and Talon, Inc., Erie.

The speaker, J. T. Welch, of the Sheffield Corp., Dayton, Ohio, presented a slide-illustrated discussion of crush dressing grinding wheels to produce intricate forms accurately and economically.

Developing the early history of crush dressing, Mr. Welch related in detail the kinds of work for which it is best suited. Each step in the making of master rolls, selection of materials, and the servicing of worn rolls was carefully explained.

The program was considered one of the most thorough accounts of a new tool which the group had heard in some time.

Educators Urge More Facilities to Train Engineers

Elmira, N. Y.—More technical institutes are needed to fill the gap between high school and college, Dr. Lynn Emerson stressed in an address April 1 before a meeting of Elmira Chapter in the Mark Twain Hotel. Dr. Emerson is Asst. Dean of the Colleges of Engineering, Cornell University, and head of the E.S.&M.W.T. courses in New York State.

Among other things, he pointed out the need of a survey to determine the kinds of jobs engineering college graduates secure. Engineering curricula could then be revised, if necessary, in order to better train such students for their life work.

Tool engineering curricula are being considered, Dr. Emerson said, as a result of pressure from prospective students and the growing feeling that tool engineering is broad enough to warrant a separate course of studies in the science.

In closing, Dr. Emerson said that the educational facilities of all colleges would be so heavily taxed this coming semester that many prospective students would be turned away.

Albert E. French, Director of Elmira Veterans' School, was the second speaker introduced by Education Chairman Varner MacRorie.

Mr. French proposed a greatly extended apprenticeship training program to be conducted in cooperation with the local public school system and industries. The courses, he said, should include various trades and be open to qualified high school graduates and adults as well as veterans.

This approach to the tool engineering profession, he emphasized, coupled with correspondence school or technical institute study, would provide considerable preparation for a career in this field.

At the conclusion of the speaking program, two films were shown, the first a General Motors release entitled, "Progress Through Engineering," and the second a technicolor exposition of the Nichols hand miller.

The latter production showed the milling machine's great versatility for short run, wide variety jobs and the ease with which it can be tooled for this type of work.

Fink Resident Manager

New York City—Harry W. Fink has been appointed Resident Manager for the New York branch office of LaSalle Engineering Co., Chicago, as announced by Harry Conn, General Manager.

H. W. Fink

Mr. Fink was previously connected with American Tool Engineering Co., New York, as Chief Designer.

He is a member of Greater New York Chapter, ASTE, and has served two terms as Chapter Secretary.

Points Out Pitfalls In Tool, Die Design

St. Louis, Mo. — Approximately 200 members and guests of St. Louis Chapter heard H. J. Stagg, of the Crucible Steel Company of America, explain "Proper and Improper Design of Tools and Dies" at a meeting held May 2 in the Melbourne Hotel.

H. J. Stagg

With the aid of slides showing tool failures caused by improper design and steels, as well as heat treatment charts and graphs, Mr. Stagg gave a dramatic presentation of his topic.

Willis Ehrhardt, St. Louis Chapter Delegate, presented an extremely interesting resume of the ASTE New Era Exposition and convention held in Cleveland, and highlights of the activities of the House of Delegates.

Pictures taken at the Cleveland Exposition were shown by Edward Oldendorf, Chief Engineer of the Production Eng. and Mfg. Co. Mr. Oldendorf, a Chapter member, gave a commentary on the slides.

Chairman J. J. Demuth asked for a moment of silence in tribute to Member Eugene J. Chally, who died on April 24.

Spring branches give a seasonal touch to April 1 dinner meeting of Elmira Chapter in Ballroom of Mark Twain Hotel. Below: Speakers of the evening, surrounded by group of Chapter officers and members, are: Albert E. French (third from left, front row), of Elmira Veterans' School, and Dr. Lynn Emerson (right of Mr. French), of Cornell University College of Engineering. Program was presented by Education Chairman Varner MacRorie (second from left).

William Connell, installing officer, entrusts San Diego Chapter charter to custody of Paul H. Whitmoyer, incoming Chairman. Other officers taking over the reins for 1946-47 are (left to right): William D. Robinson, First Vice-Chairman; J. W. Wilde, Second Vice-Chairman; R. E. Nichols, Secretary; Clarence R. La Course, Treasurer; and Sherman C. Brunton, Chapter Delegate. At right are: W. J. Hennessy and Roger Alexander of Machinery Sales Co., Los Angeles, and Robert Manly of Bryant Chucking Grinder Co., Springfield, Vt., who conducted technical session, "Tooling for Better Internal Grinding."

Appeals for Co-operation In Postwar Problems

San Diego, Calif.—San Diego Chapter changed its official family in a simple but impressive ceremony at the annual meeting for the installation of officers.

In his farewell address, William F. Asmus, retiring Chairman who has been active in ASTE affairs in this region for many years, praised unstintingly both officers and committee chairmen whose untiring efforts contributed much to the success of the year's activities.

Mr. Asmus turned the meeting over to "Bill" Connell, inimitable and beloved master of ceremonies of long standing, who administered the oath of office to: Paul H. Whitmoyer, Chairman; William D. Robinson, First Vice-Chairman; John W. Wilde, Second Vice-Chairman; Robert E. Nichols, Secretary; and Clarence R. La Course, Treasurer.

The ceremony was concluded with a short talk by the new Chairman, Mr. Whitmoyer, who spoke of the challenging problems the Chapter will face in the coming year. He appealed for the co-operation of every member in successfully overcoming obstacles expected in the fast changing developments of the postwar era.

A story of "Tooling for Better Internal Grinding" was unfolded by means of a film sponsored by Bryant Chucking Grinder Co. of Springfield, Vt. The program was ably conducted by W. J. Hennessy and Roger Alexander of Machinery Sales Co., Los Angeles, and Robert F. Manly of Bryant Chucking Grinder Co.

Program Chairmen

Read news of other Chapters for information concerning new technical speakers.

Karash Lectures On Dies For Inclined Presses

South Bend, Ind.—J. I. Karash, Plant Engineer of the Reliance Electric & Engineering Co., Cleveland, Ohio, addressed South Bend Chapter at their April meeting. Mr. Karash's subject was "Design of Dies for Inclinable Punch Presses."

J. I. Karash

The speaker described dangers inherent to the vertical press and mentioned some of the makeshift safety devices in use. These include draw bracelets, swinging arms, drop guards and miscellaneous safeguards.

The only completely satisfactory way to develop a safe machine, he said, is to keep the operator's hands completely out of the danger area. This is best accomplished by using inclined presses.

Stresses Correct Use of Pins

Designing of dies for the inclined press was described in detail with the aid of slides. Special attention, Mr. Karash cautioned, must be paid to the proper use of knock-out pins in the ram, and "jigger" pins in the die. For single pieces the part must be so arranged that there is a protruding corner for removing scrap. On secondary operations a pilot must be provided to locate the work.

Mr. Karash advocated the use of a variable speed mechanism to insure a constantly operating press. The fatigue of operating a foot pedal is not present in a continually operating press, he pointed out. An air clutch should be provided, the speaker advised, to avoid smash-ups resulting from having two pieces in the press at one time.

German Production Trailed Science

Racine, Wis.—German scientists were so far ahead of Nazi industry that their discoveries could not be absorbed and put into production, Fred Young, President, Young Radiator Co., Racine, informed Racine Chapter in an address before their April 1 dinner meeting at the Manufacturers Association Building.

Mr. Young was well qualified to discuss his subject, "German and European Production and Facilities," having served on a U. S. Government Technical and Industrial Intelligence Committee. The Committee was delegated to the task of searching out inventions and industrial processes before the Germans could destroy them.

American products, he pointed out, far exceeded Germany's in performance efficiency. Radiators were below American standards in cooling qualities, while oil coolers used in airplanes were inferior to those manufactured in this country.

Working against tremendous odds, German engineers, Mr. Young stated, accomplished much in the face of material shortages and other difficulties.

The American industrial setup, he concluded, is far superior to anything he saw on his European trip.

Slides of German factory ruins and well-known places on the continent illustrated Mr. Young's talk. His display of trophies and radiator parts was viewed with keen interest.

Simonds Co. Shows Plant Operations

Worcester, Mass.—A visit to the plant of Simonds Saw & Steel Co. at Fitchburg featured the April 1 meeting of Worcester Chapter.

Officials of the Simonds Co. extended a cordial welcome to the members before they were escorted through the plant to observe production lines and other operations. Following the tour, the group adjourned to Hotel Raymond where dinner was served.

Chairman Albert T. Warman presided over the subsequent business meeting, turning the technical program over to First Vice-Chairman Charles W. Monigle.

Mr. Monigle introduced J. D. McCready, Ass't Sales Manager of the Simonds Co. who described the manufacture of machine knives, illustrating his remarks with a film, "Machine Knives in Industry."

The film story opens at the laboratory and steel mills at Lockport, N. Y., proceeding to the factory at Fitchburg, with the final sequences showing the knives in actual plant operation.

Fred Young (inset), President of Young Radiator Co., Racine, gives members of Racine Chapter an account of his postwar tour of German plants. Mr. Young was the speaker at April 1 meeting in the Manufacturers Association Building. At left is his exhibit of German souvenirs and radiator parts.

Bonte Names Advantages Of Graphitic Steels

Philadelphia, Pa.—F. R. Bonte, Development Engineer of the Timken Roller Bearing Company's steel and tube division, gave Philadelphia Chapter an informative discourse on "Graphitic Steels" at their April 18 meeting.

Mr. Bonte, an inventor of graphitic steels, augmented his lecture with color slides concerning the manufacture, properties and applications of these steels.

Graphite Improves Qualities

The speaker showed, with the aid of photomicrographs, that graphitic steel contains free carbon in the form of graphite. This free graphite imparts to the steel greater machineability, imbues it with a high resistance to wear, and gives it good frictional properties with less tendency for pick-up and scoring than is found in other tool steels.

Chemical composition of the steels, Mr. Bonte said, is constantly checked for uniformity by sending specimens to the laboratory for observation under the microscope. Photomicrography is frequently used so that pictorial records of the specimens may be had.

Chemical Uniformity Necessary

A carefully controlled chemical composition makes possible the precipitation of free graphite from the total carbon content during the normalizing and annealing treatment. Uniformity in chemical composition of steels is essential to the user for heat treating purposes, particularly when large quantities are being produced.

Numerous test bars subjected to various types of experiments prove the high physical properties which graphitic steels possess. Charpy impact tests disclose its malleability and uniform grain structure.

Heat treatment and hardness tests reveal the same excellent heat treating properties that are found in other tool steels.

In color slides the members saw a battery of electric furnaces used to melt graphitic steel, and special forging and rolling equipment designed to produce a high quality finished product.

Flexible in Application

Graphitic steel, the speaker pointed out, may be worked hot or cold and is obtainable in rounds, hexagons, flats, sheets and seamless tubing. It is applicable to all types of forgings.

Before dinner, Alfred S. Elston, Education Chairman, offered the invocation in a tenor solo significant of the Easter season. Later, community singing was enjoyed by the gathering.

Thomas J. Donovan, the Chapter Delegate, reported on the activities of the national convention at Cleveland.

Retiring Chairman A. R. Gieringer of Milwaukee Chapter presents official gavel to Chairman Richard Ford at installation ceremonies, while other officers look on. Left to right: Mr. Gieringer, Paul Butzin, First Vice-Chairman; Joseph Ebner, Second Vice-Chairman; Herbert Heimann, Treasurer; Mr. Ford, and Norbert Husting, Secretary. Order is maintained without resorting to emergency "club gavel."

New Officers Inducted By National Director

Los Angeles, Calif. — Installation of Los Angeles officers was conducted before an audience of 182 members and guests during a recent dinner meeting at Scully's Cafe.

National Director A. J. Denis, the presiding officer, installed: Chairman, Anton Peck, Jamison Steel Co.; First Vice-Chairman, Leslie F. Hawes, Southern California Metal Products; Second Vice-Chairman, Gerald Stronks, Snyder Engineering Co.; Secretary Virgil Weidemann, Northrop Aircraft Co.; and Treasurer, Jake Walkey, Lockheed Aircraft Co.

Appoints Committee Chairmen

Mr. Peck, the new Chairman, introduced as Committee Chairmen: Public Relations, Arthur J. Thompson, Northrop Aircraft; Education, Joseph Berry; Membership, Rudolph Powroznick, Menasco Mfg. Co.; Editorial, Rudolph Regen, General Machine Works; Constitution and By-Laws, Stanley Adamic, New Plastic Corp.; Standards, M. W. Seavey, Lockheed Aircraft Corp.; and Entertainment, Harold L. Miller, Adel Precision Products Corp.

The first speaker of the evening, L. R. Twyman, Hydraulics Engineer and Manager of the Industrial Division of Vickers, Inc., Detroit, discussed the uses of hydraulics in modern equipment, illustrating his talk with Kodachrome slides.

Robert B. Walder, Research Engineer for Rheem Manufacturing Co. and Consulting Engineer for Pacific Aviation Corp., concluded the evening's program with a talk, "Postwar Production Challenges the Machine Tool Designer."

"Story of Formica" Told At Installation Meeting

Milwaukee, Wis.—Chapter officers for 1946 were installed by retiring Chairman A. R. Gieringer at a recent meeting of Milwaukee Chapter.

The executives who assumed their official duties are: Richard Ford, Chairman; Paul Butzin, First Vice-Chairman; Joseph Ebner, Second Vice-Chairman; Norbert Husting, Secretary; and Herbert Heimann, Treasurer.

S. P. Walsh, Field Engineer for the Formica Co., gave an informative talk, accompanied by motion pictures showing the discovery of the Formica process, its development through various stages, and its present applications.

Discovery of the process was reviewed. The base material, applied to paper and other materials, is subjected to pressure to give the final product known as Formica.

Uses of Formica were described, in conjunction with labor-saving methods where intricate forms must be made with rugged materials non-conductive of electricity.

A lively discussion period followed the interesting program.

Professor Guest Speaker

Decatur, Ill.—Dr. C. A. Siebert, Consulting Metallurgical Engineer and Professor of Metallurgical Engineering, University of Michigan, Ann Arbor, Mich., was the technical speaker appearing before Decatur Chapter, May 13.

Dr. Siebert's presentation of his subject, "Metallurgical Factors Related to Tool Design," reflected his wide experience in this field.

The meeting, held in the Decatur Club, was attended by 33 members and guests.

Philadelphia Chapter officers chat during dinner which preceded April 18 meeting. Left to right: John P. Clark, Jr., Public Relations Chairman; Leonard S. Subber, Standards Chairman; Samuel R. Boyer, Second Vice-Chairman; Arthur R. Diamond, First Vice-Chairman; and the guest speaker, F. R. Bonte of Timken Roller Bearing Co. Audience (right) finds Mr. Bonte's lecture on superior qualities of graphitic steel very informative and educational.

Multi-Rib Wheel Newest Thread Grinding Development

Rochester, N. Y.—Installation of Chapter officers and announcement of committee appointments opened a recent Rochester Chapter technical meeting at Rochester Institute of Technology.

Ernest V. Flanders, Chief Engineer, Thread Grinding Dept., Jones & Lamson Machine Co., Springfield, Vt., delivered the technical address of the evening. His subject was "Modern Developments in Threading."

Co-holder, with his brother, Ralph E. Flanders, of the Longstreth Medal awarded by Franklin Institute "in recognition of their outstanding work in developing thread grinding machinery," Mr. Flanders is an ardent ASTE'er. It was under his administration as Chairman that Twin States Chapter first captured the ASTE National Membership Trophy in 1943.

After installing Rochester Chapter's new officers, Past Chairman Joseph Schick (left) hands gavel to Chairman Charles Seely. Other officers are (left to right): Milton Roessel, First Vice-Chairman; Herbert Simon, Second Vice-Chairman; William Gordon, Third Vice-Chairman; Martin Ness, Secretary; and Fred Bittner, Treasurer. Installation Night was held at Rochester Institute of Technology.

He is a former Rochester resident and student of Rochester Institute of Technology.

In developing his topic, Mr. Flanders reviewed recent improvements in threading practices, beginning with James Hartness' invention of the screw thread projector soon after World War I.

This device furnished a means for studying the screw thread so that the form, lead and smoothness could be improved, and drunkenness overcome. Through its demands for better threads, the aviation motor industry, he observed, was the impelling force in the improvement of threading practices.

Thread Rolling Improved

Threadmaking prior to World War II, he recalled, was with solid and collapsible dies, rolling, milling, and grinding with single rib grinding wheels. Thread rolling, done between two flat dies with thread scores, was not too accurate. Now, by grinding the thread form in the rolling dies, it is possible to consistently obtain class three threads. Equivalent to ground threads, these rolled threads have greater strength because of the working and densifying of the metal.

With flat dies and heat treated metal, Mr. Flanders continued, it was frequently necessary to run the piece through the dies twice. The invention and development of circular dies eliminated this double operation.

In the Reed type, three circular dies are spaced equidistant around the piece. The Germans used two circular dies spaced diametrically opposite in the so-called "PeeWee" machine, but threads produced by this method do not equal those made on the Reed machine.

Quoting Major Smith of the U. S. Army, Mr. Flanders indicated that the German High Command did not realize the necessity for high precision threads in aviation engines. This was an important factor in their lack of aircraft during the last months of the war as they had plenty of engine parts ready for assembly but no studs.

Modifications by Grinding

For special ordnance applications during the war, many different modifications of threads were made by grinding, especially of the rounded crest and bottom similar to the lamp socket type of thread.

The latest development in thread grinding, the speaker announced, is the multi-rib type of grinding wheel. Alternating ribs are omitted when sharpening the wheel with a diamond. This gives room for a larger and stronger diamond. Sharpening the wheel with a diamond gives a superior finish, he pointed out.

In summary, Mr. Flanders said that some wheels are dressed with a roughing rib, a semi-finishing rib and a finishing rib corresponding to the chamfer on a set of collapsible die chasers. Sometimes, the threading wheel has a flat wheel ahead of it and one following to permit removal of the partial thread at the beginning and end of a thread.

Taper threads are ground by means of an actuating cam, while taps are thread ground and relieved at the same time. Thread grinding may be done on soft, heat-treated and hardened ferrous material as well as on most types of non-ferrous material, he concluded.

Sound films of thread grinding with the single rib wheel were shown, as well as slide pictures of other types of thread grinding.

Past Chairman Joseph Schick, the installing officer, called the officers-elect to the rostrum, swearing each to the conscientious performance of his duties.

New Officers Installed

Those inducted were: Chairman, Charles Seely, International Business Machines Corp.; First Vice-Chairman, Milton Roessel, Graflex, Inc.; Second Vice-Chairman, Herbert Simon, Rochester Products Div., G.M.C.; Third Vice-Chairman, William Gordon, Eastman Kodak Co., Camera Works; Secretary, Martin Ness, Teale Machine Co.; and Treasurer, Fred Bittner, Commercial Controls Corp.

Committeemen serving with these officers on the Chapter Executive Board are: Education, Sherman Hagberg, Rochester Institute of Technology; Program, Lawrence Bates, *Screw Machine Engineering;* Constitution and By-Laws, James O. Horne, Jr., Manufacturer's Representative; Membership, Charles DeMartin, Lucas Screw Products, Inc. Standards, Russell Howard, Bausch & Lomb Optical Co.; Public Relations, Robert T. Barnett, R. T. Barnett Co.; Industrial Relations, Emmett Moore, Ritter Co., Inc.; Editorial, E. Leroy Hand, Gleason Works, assisted by George E. Codd, Delco Appliance Div., G.M.C.; Historian, Charles E. Codd, Ritter Co., Inc.

Entertainment, Ernest Straw, Ex-Cell-O Corp; Advertising, Earl Gruendike, General Railway Signal Co.; and Delinquent Membership, Earl Roller, Liberty Tool & Die Corp.

Among the 100 members and guests present were B. W. Jones of Elmira Chapter and Past Chairman Stephen Urban of Syracuse Chapter.

Many Factors Govern Choice of Die Steels

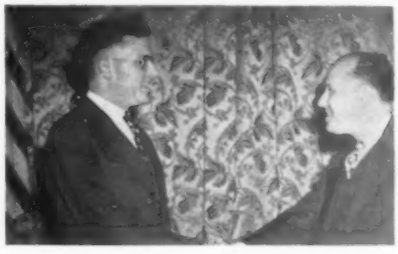
Pittsburgh, Pa.—Dr. G. M. Butler, Associate Director of Research, Allegheny Ludlum Steel Corp., Dunkirk, N. Y., gave an address on "Selection of Cold-Work Die Steels" before approximately 125 members and guests of Pittsburgh Chapter at a dinner meeting April 5 in the Fort Pitt Hotel.

Dr. Butler's paper covered practical considerations in selecting cold-work die steels, including comparative properties of available steels, experience and skill of workmen with different steels, volume of production, material to be worked, required quality of parts to be made, and other factors.

A feature of his lecture was a group of four tables grading eight types of cold-work die steels in resistance to distortion during heat treatment, by wear resistance, toughness, and ease of machining.

The program was rounded out with two Allegheny Ludlum sound and color motion pictures. The first, "Exploring with the Microtimer," showed machining operations on stainless steels, in ultra slow motion. The second showed the manufacture of high precision dies for stamping electrical equipment laminations.

William H. Schott (right), Chairman of Pittsburgh Chapter, expresses appreciation of group for fine lecture on Cold-Work Die Steels given by Dr. G. M. Butler, Associate Director of Research, Allegheny Ludlum Steel Corp. Dr. Butler spoke at April 5 meeting in Fort Pitt Hotel.



Internal Grinding Film

Dayton, Ohio—April meeting of Dayton Chapter featured an excellent color film, produced by Bryant Chucking Grinder Co., showing a number of novel applications of tooling for internal grinding.

R. F. Manly of the Bryant Company presented the film and conducted a lively discussion forum at its conclusion.

New Committeemen Aid in Expanded Handbook Activities

A RAPIDLY RISING TIDE of incoming manuscripts for the "Tool Engineers' Handbook" has necessitated the addition of two new members to the Handbook Committee, Chairman E. W. Ernst has announced. The recent appointees are Ben C. Brosheer, Associate Editor, *American Machinist*, Chicago, and Harry Crump, Chief Tool Sales Engineer, Carboloy Co., Detroit.

B. C. Brosheer

Harry Crump

Both committeemen have been selected for their industrial and editorial experience. Both have been active in the Society. Mr. Brosheer has held a number of offices in Northern New Jersey and Chicago Chapters. He has also served on the National Public Relations Committee.

Mr. Crump is a Past Chairman of Schenectady Chapter, a contributor to trade magazines, and has appeared as a technical speaker before ASTE Chapters.

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Among prominent writers preparing the editorial contents of the Handbook are: **A. H. Petersen**, Production Methods Department Engineer for Lockheed Aircraft Corp., Burbank, Calif.

For five years Mr. Petersen has been delving into various manufacturing aspects of aircraft design, such as development and research into production methods, chemical processes and metallurgy, and control of production design.

Taught War Courses

In addition he has acted as Consulting Engineer for foundries, fabrication shops, and other industries dealing with design and production problems. To further assist in the national emergency, he taught several courses in Production Engineering and Production Design for the University of California.

Before going to the West Coast, Mr. Petersen acquired an extensive industrial background in Chicago where he planned all tools, processes and production for two can and metal cap plants, designed for a motor truck builder and a printing press company, and served as foreman in metalworking shops.

He is the author of technical articles which have appeared in *Industrial Aviation, Iron Age, Air and Automotive Industries*, and *Product Engineering*.

A member of Los Angeles Chapter, ASTE, Mr. Petersen is also affiliated with ASM, and is Western Regional Director for ASIE.

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As a blueprint boy with the Lecourtenay Co., Newark, **William F. Buhl**, now Secretary-Treasurer of the Terrace Tool and Gage Co., Morristown, N. J., first became interested in engineering.

Completion of a five-year evening course in Mechanical Engineering brought him advancement to draftsman. Subsequently promoted through various engineering positions to Acting Purchasing Agent, he studied at the School of Business, Rutgers University, majoring in Business Administration.

Published Procedures

For three years he was assigned to the development of forms, systems, methods and codes to expedite clerical routine. A number of articles on these procedures, written by Mr. Buhl, have been published in national magazines such as *American Business, Purchasing, Factory Management*, and *Mill & Factory*.

During the war, he devoted his evenings to managing the Terrace plant, assisting in the designing of jigs, fixtures and tools and taking over the presidency when the owners entered the armed forces. Recently he terminated his activities with the Lecourtenay firm to assume his present position with the Terrace Company.

The development of Buhl, Thomas & Gould, Inc., of Morristown, a new company formed by Mr. Buhl and two of his associates, now occupies his spare time. The new concern is entering the metal toy field.

Waldemar Naujoks

C. E. Tarpley

Working after school and during summer vacations, **Waldemar Naujoks**, Chief Engineer, The Steel Improvement & Forge Co., Cleveland, Ohio, learned the rudiments of metalworking in his father's hand-forging shop at Milwaukee, Wis.

After leaving school, he completed an apprenticeship as toolsmith and machinist. Then he entered the Navy, serving as instructor in hand forging at Charleston Navy Yards, S. C.

Over a 13-year period of alternating industrial work and study, he acquired a B.S. in Mechanical Engineering, an M. S. in Metallurgical Engineering and the degree of Mechanical Engineer from the University of Wisconsin.

Meanwhile, in 1928, he had begun his association with the Steel Improvement & Forge Co., as Mechanical Engineer.

Author of "Forging Handbook"

Mr. Naujoks is considered an outstanding authority on forging practice and is active in writing and lecturing. In addition to more than 50 articles published in leading technical journals, he has written the "Forging Handbook" and other works.

He has spoken before Chapters of ASM, ASME, and ASTE in this country and Canada. He is a member of the Technical Committee of the Drop Forging Association, the ASM Forging Committee, Cleveland Engineering Society, ASME, and the National Aeronautic Association. A registered Professional Engineer in the state of Ohio, he serves as Treasurer of Cleveland Technical Societies Council. His affiliations also include a number of civic and social organizations.

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Activities ranging from prospecting for oil to teaching engineering have figured in the career of **C. E. Tarpley**, Assistant Chief Engineer, Powder Metallurgy Corp., Long Island City, N. Y.

After graduating in Mechanical Engineering from the University of Illinois, in 1937, he was employed by a geophysical company prospecting for oil, and later in a production capacity by the American Can Co., at Houston, Texas.

Elected to Honor Societies

Returning to his alma mater in 1939 for two years of graduate work, he was elected to Sigma Xi and Pi-Mu-Epsilon, honorary scientific and mathematic societies, respectively.

A teaching post in the Engineering College of New York University followed the granting of his master's degree in Theoretical and Applied Mechanics by the University of Illinois.

In 1943 Mr. Tarpley became associated with his present company, a subsidiary of General Bronze Corp. Since then he has been concerned with the design and manufacture of tools and dies for powder metallurgy and the production of powdered metal parts.

A. H. Petersen

W. F. Buhl

R. P. Seelig, Chief Engineer of the Powder Metallurgy Division and a well-known technical author, is collaborating with Mr. Tarpley on a section of the Handbook.

Iversen Shows Broaching In New Applications

Kansas City, Mo.—Norman Iversen, Chief Engineer of Michigan Broach Co., Detroit, spoke before Kansas City Chapter, May 1.

The subject of Mr. Iversen's address was "Broach Design and Practical Production Broaching." Two motion pictures were shown to illustrate some of the many new applications for broaching that have been developed in the past two or three years. Mr. Iversen also used black-board illustrations to show advantages of broaching.

His talk covered the important part the broach manufacturer can play to assist in engineering the tooling of parts to take fullest advantage of this economical machining process.

The meeting and dinner were held at the Fred Harvey dining room in Kansas City's famous Union Station Plaza. Several out-of-town guests were present. An open forum discussion closed the program.

Rubber Executive Urges Synthetic Program

Pittsburgh, Pa.—The United States should develop a program to produce domestically-manufactured synthetic equivalent to 50% of the national rubber consumption, according to D. M. Rugg, Vice-President in Charge of Kobuta Rubber Plant, Koppers Co., speaking May 3 before a Pittsburgh Chapter meeting in Fort Pitt Hotel.

Located thousands of miles away, the principal source of natural rubber could be cut off, Mr. Rugg warned. Adoption of a sound policy on synthetic production, he advocated, would insure American industry and consumers an adequate rubber supply at a fair price.

Mr. Rugg also gave an interesting outline of various types of synthetic rubber and their uses.

William H. Schott (left), Chairman of Pittsburgh Chapter, welcomes D. M. Rugg, Koppers Co. rubber plant head and speaker May 3 at Chapter meeting. Mr. Rugg talked on "Manufacture and Use of Synthetic Rubber."

Guests at the meeting included a number of National Officers and Committeemen: A. M. Sargent, President; T. P. Orchard, Second Vice-President; I. F. Holland, Third Vice-President; H. E. Conrad, Executive Secretary; H. D. Hall, National Program Chairman; and E. W. Baumgardner, National Program Committee Secretary.

W. B. Peirce, First Vice-President, and R. W. Ford, First Vice-Chairman of the National Program Committee, also present, are members of the Chapter.

Mr. Peirce presented President Sargent who spoke briefly on the success of the New Era Exposition at Cleveland and cited illustrations reflecting the rapid growth and popularity of the Society.

The dinner attendance of 113 increased to 138 for the technical meeting.

Butadiene Manufacture Demonstrated to Texans

Houston, Texas.—Processes used in making Butadiene were recently demonstrated to members of Houston Chapter at the Sinclair Rubber Company plant.

Dinner was served in the company cafeteria to approximately 100 members, followed by the regular business meeting.

C. W. Hardell, Sinclair Process Superintendent, explained the various steps in manufacturing Butadiene, illustrating his talk with the film, "Victory in Rubber."

The members were then divided into groups, each accompanied by a guide, for a tour of the plant and all facilities, completing an interesting and educational evening.

Sapphire Gages Infallible, Waindle Tells Engineers

San Francisco, Calif.—Golden Gate Chapter was treated to an especially interesting technical session on the subject, "Sapphire—An Engineering Material," by Roger F. Waindle, General Manager, Elgin Watch Co., Sapphire Products Div., Aurora, Ill. Mr. Waindle was the principal speaker at the April 17 meeting in the Engineers Club.

R. F. Waindle

He described, with the aid of a sound-color film, the process used in developing the synthetic sapphire bearing. The speaker outlined some of the practical uses of this outstanding material, to the end that tool engineers may compare the optical, chemical and physical properties of synthetic sapphire with more familiar materials.

Bearings for Chronometers

Of especial interest was his description of the various stages in the manufacture of sapphire bearings for chronometers. This included the development of the sapphire boule and lapping operations needed to convert the square sapphire block into an accurate bearing for fine instrument mechanisms.

Slides, depicting charts, were shown to compare synthetic sapphires with other materials.

Commenting upon this unique product as a construction material for engineers, Mr. Waindle pointed out that its physical characteristics make it particularly adaptable for use in gages, wearing surfaces, cutting tools, micrometer tips and other uses where extreme stability, minimum porosity, and high surface finish are prime requisites. "It has been found impossible for sapphire gages to become inaccurate," said Mr. Waindle.

Miles H. Anderson, Assistant Supervisor of Trade and Industrial Teacher Training, Bureau of Trade and Industrial Education, gave an excellent after-dinner talk. His subject was "Apprenticeship Training."

Mr. Anderson enlightened those present concerning steps now being taken to insure future craftsmen more thoroughly trained in fundamental operations. He explained how the program will affect the student-veteran returning to civilian life.

Edward J. Raves, Chairman, in conducting his first meeting, indicated his intention of bringing the membership into closer contact with the various Committee Chairmen, by outlining the functional duties of Committee members.

Reed Demonstrates Thread Rolling

Flint, Mich.—More than 100 members and guests of Flint Chapter were present to hear A. Bradford Reed explain the advantages and limitations of the thread rolling process, at a meeting held April 19 in General Motors Institute. Mr. Reed is President and Treasurer of Rolled Thread Die Co., Worcester, Mass.

In his talk he explained the fundamentals of thread rolling and described the developments in machinery and techniques which preceded the present cylindrical roll design. This machine has three cylindrical rolls spaced 120° apart and is operated by cam and toggle action.

One of these machines was installed in the machine shop of the Institute where a demonstration was given after the technical session. Here studs were threaded to demonstrate the action of the machine, its speed, and the quality of the thread produced.

Later the machine was partially disassembled to permit study of its component parts. Mr. Reed also provided a display of numerous parts, including worms, which were threaded by this method.

An additional display of roll-threaded spark plugs was provided by Technical Chairman Kenneth A. Johnson, Superintendent of Manufacture at A.C. Spark Plug Div.

The technical session was preceded by an excellent report of the House of Delegates Meeting at Cleveland, given by Flint Chapter Delegate Clyde Fanning.

A. Bradford Reed, President and Treasurer of Rolled Thread Die Co., Worcester, Mass., explains a point in thread rolling to Technical Chairman Kenneth A. Johnson of Flint Chapter. Mr. Reed was guest speaker at the Chapter's April 19 meeting in General Motors Institute. Members and guests study construction and performance of machine on which Mr. Reed conducted thread rolling demonstration.

Officers participating in Springfield (Ill.) Chapter installation ceremonies are (seated, left to right): Henry Becker, First Vice-Chairman; Harry H. Washbond, Chairman; and John V. Javorsky, retiring Chairman and installing officer. (Standing): Theodore Schlitt, Secretary; Paul Knecht, Treasurer; and Francis James, Second Vice-Chairman.

Safety Conference, Exhibit Featured

Fort Wayne, Ind.—April dinner meeting of Fort Wayne Chapter was held in the Chamber of Commerce, on the 10th, in conjunction with the Third Annual Northeastern Indiana Safety Conference and Exhibit sponsored by the Industrial Safety Division of the Chamber of Commerce Safety Council.

The Conference, attended by safety directors, plant executives and purchasing agents from all industry in the area, was highlighted by extensive exhibits featuring latest equipment and safety practices of 27 leading manufacturers of nationally known safety products.

The combined dinner meeting was attended by 211 tool engineers and safety men who were addressed by E. Clark Woodward, Director of Safety at Illinois Institute of Technology, Chicago. As Director of Wartime Safety Training in the Institute's Engineering, Science and Management War Training program, he was directly responsible for the training of more than 3,500 persons during the war.

Must Instill Safety Practices

Accidents, Mr. Woodward stressed, do not happen; they are always caused. Industrial accidents, he said, can be decreased by practicing safety from top management on down. Man, he pointed out, is born with only the fundamental instincts of self preservation, and most safety practices must be learned by doing and repetition until they become automatic.

After a short recess, H. R. Husted, Technical Service Engineer of the Celanese Plastics Corp., spoke and presented a sound film on "The Shape of Things to Come." This production depicts the important part the plastics industry is destined to play in the postwar era and the machinery, methods, and tooling employed in the moulding of plastic products.

He pointed out that the use of plastics must be thoroughly engineered to guarantee successful application. The plastics industry, he stated, has had to learn the best methods by trial and error like other industries.

The membership maintained a discussion of plastics through an extensive question and answer period following Mr. Husted's talk.

Milton H. Kline, Fort Wayne Chapter Delegate, presented a report on the House of Delegates meeting at the Cleveland convention.

Production Welding

Springfield, Ill. — Approximately 65 members and guests of Springfield Chapter attended the April meeting in Hotel Abraham Lincoln.

F. J. Hirner, District Manager of Harnischfeger Corp., St. Louis, Mo., spoke on "Arc Welding," its effects on machine design, and the P. & H. production welding control system.

The address was illustrated with a sound motion picture and lantern slides.

* * *

At an earlier meeting, new officers were installed by retiring Chairman John V. Javorsky. Those taking the oath of office were: Harry Washbond, Chairman; Henry Becker, First Vice-Chairman; Francis James, Second Vice-Chairman; Theodore Schlitt, Secretary; and Paul Knecht, Treasurer.

Jasper Joins Reynolds

Louisville, Ky.—Kenneth C. Jasper, formerly Methods Engineer for Westinghouse Electric Corporation, has accepted a similar position with Reynolds Metals Company.

K. C. Jasper

Mr. Jasper, a National Director of ASTE, has held offices in Tri-Cities and Louisville Chapters.

He is a lieutenant commander in the State Militia Air Force, a C.A.P. Wing Training Officer, member of the National Aeronautical Association, American Radio Relay League and the American Arbitration Association.

NAM Speaker Outlines Engineer's Prospects

Cleveland, Ohio—Featured speaker at Cleveland Chapter's May 10 meeting was Dr. Neal Bowman of the National Association of Manufacturers, whose subject was "Industry Looks Ahead."

Dr. Bowman, who has made people, their jobs, ambitions and problems his life work, discussed future possibilities for today's engineer in industry. An expert on industrial supervisory relations, Dr. Bowman is an outstanding platform personality, having addressed hundreds of industrial audiences.

The VT proximity fuse, considered of only slightly less military importance than the atomic bomb, was explained by Jean P. Teas, Jr., head of the Works Laboratory, Edgewater Works, National Carbon Co., Cleveland.

A former U. S. Army Captain, Mr. Teas served as a Liaison Officer to the development laboratories working on these fuses. Later he accompanied the first VT fuses shipped to England, subsequently instructing American and British military personnel in the use of the new weapon.

Dr. Neal Bowman, of the National Association of Manufacturers, gets across a point in his address, "Industry Looks Ahead," before May 10 meeting of Cleveland Chapter. First Vice-President W. B. Peirce (seated at his left) is an appreciative listener. At right, Jean P. Teas, Jr., of the National Carbon Co., Cleveland, relates "Development and Combat Use of VT Proximity Fuses in World War II."

Among guests present at the meeting were W. B. Peirce, First Vice-President, and Harry E. Conrad, Executive Secretary, ASTE; William H. Schott, Chairman of Pittsburgh Chapter; and Guy Hubbard, Machine Tool Editor of *Steel*.

Ladies Entertained

Toronto, Ont.—Passing up all technical problems, Toronto Chapter members played host to their ladies at a recent dinner and dance in the Royal York Hotel.

Mrs. Crawford

Chairman Walter Appleton welcomed the 326 members and friends, announcing that a gala evening had been planned. Entertainment during and after dinner kept the company in gay spirits.

Past Chairman Eric Crawford proposed the toast to the ladies to which Mrs. Crawford responded. She spoke quietly, with composure and much good humor. Her speech was one of the highlights of the evening.

Researcher Talks On Metal Cutting

Fond du Lac, Wis.—Dr. Hans Ernst, Director of Research, Cincinnati Milling Machine Co., lectured on "Metal Cutting Research" before members of Fond du Lac Chapter at a meeting held April 5 in the Flamingo Club near Sheboygan.

Dr. Hans Ernst

In conjunction with his address, Dr. Ernst showed slides and slow motion pictures depicting the actual process of metal cutting.

Another film, "The Age of Precision," was screened after dinner. This production indicated how advancements in over-all precision manufacturing have been dependent upon developments in grinding and other abrasive cutting operations.

Entertainment was provided by the Sheboygan Barber Shop Quartette.

Among the 142 members and friends present were two foreign guests, Yung Wang and Kas Wen-Ping, both of China.

Germans Defy Occupation While Japs Co-operate

Williamsport, Pa.—Seventy members and guests of Williamsport Chapters, ASTE and ASME, attended a joint dinner meeting April 8 at the Home Dairy to hear Sidney D. Milnor relate his war experiences as a Red Cross field director.

Chairman J. L. Strasburg of the ASTE group presided, and J. C. Reed of Bucknell University Faculty announced interesting events planned by the ASME Chapter.

Describing his experiences in Europe, Japan and the Philippines, Mr. Milnor, the guest speaker, explained the world-wide activities of the Red Cross.

He stressed the importance of the attitudes of conquered peoples toward the occupational forces. While the Germans are uncooperative, he said, most Japanese accept defeat as liberation and are eager for democracy.

A film, "Zinc Alloy Die-Casting," was shown as the technical feature.

Foolproof Fixture Design Stressed by Andrew

South Bend, Ind.—William K. Andrew, of Kearney & Trecker Corp., Milwaukee, Wis., addressed South Bend Chapter at their March meeting. Mr. Andrew's subject was "Fixture Design."

For proper design, Mr. Andrew said, the following points should be taken into consideration: number of parts to be run, equalizing clamps, secure holding, chip disposal, set-up blocks, cutter life, rotary fixtures, multiple units, number of cutters on the arbor, and cutter material.

The speaker showed slides of various machines made during the war and used for a single purpose. Built with many standard units, these machines may be converted for peacetime operation.

Mr. Andrew emphasized the need for designing fixtures that were foolproof so that the operator could not install the part incorrectly. The clamping device should be air-operated so that the correct amount of holding pressure is always used, he pointed out. For high production work the drum or transfer type of machine was recommended.

The speaker gave illustrations of how cutter life must be considered when setting the speed of a job. Most work can be run at a much higher speed than is normally used, he added, but at the higher speed the cost of changing cutters and cutter maintenance is too excessive for profitable operation. Cutter life must always be balanced with operating speed, he concluded.

A short motion picture showing the construction of the Martin "Speedraft" was screened and explained by Mr. Martin.

During the evening retiring Chairman Paul Winklemann introduced the incoming officers: Chairman Carl C. Stevason; First Vice-Chairman Edgar W. Helm; Second Vice-Chairman Norman R. Smith; Treasurer Lynn H. Sprunger; Secretary Maxwell L. Cripe; and Delegate Horace R. Wentzell.

Mr. Stevason, the new Chairman, announced the following committee appointments: Entertainment, Andrew Nemeth; Membership, Horace Wentzell; Publicity, Joseph Kim; Public Relations, Lester St. Clair; Standards, Hans Hanson; Constitution and By-Laws, Norman Shafer; Education, Thomas Thurston; Editorial, Paul Beeler; Advisory, Paul Winklemann.

Ladies Night Party

Rochester Chapter entertained their ladies recently with a dinner and dance in the Powers Hotel. Top: Retiring Chairman Earl DeBisschop officiates as toastmaster. At left are Charles Seely, Mr. DeBisschop's successor, and Mrs. Seely.

Below: Harry Foster Welch, the original "Popeye," amuses with impersonations of well-known comic strip characters. James Horne, Jr., new Constitution and By-Laws Chairman, and Mrs. Horne enjoy diversion.

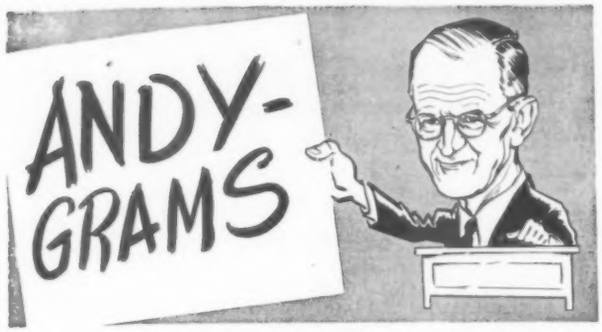
Dinner, strolling musicians and dancing completed a pleasant evening. Ladies received favors. Affair was attended by 170 members and guests.

Lane Now Works Manager For Progress Mfg. Co.

Philadelphia, Pa. — David Lane, formerly of Heintz Mfg. Co., has accepted the position of Works Manager for Progress Mfg. Co., Inc., Philadelphia, manufacturers of fluorescent and other lighting fixtures.

Mr. Lane is a member of Philadelphia Chapter, ASTE.

More than 140 tool engineers in the Fond du Lac Chapter area turned out to hear Dr. Hans Ernst, of the Cincinnati Milling Machine Co., discuss "Metal Cutting Research." Dr. Ernst, who is Director of Research for his company, is well known as a technical author and lecturer. Meeting was held April 5.



As I've said before, it's been a tough "first hundred years," what with starting the new *Tool Engineer* from scratch, eighteen months ago, and subsequent growing pains in nowise alleviated by cramped quarters. But now, we're on the high road to the happy millenium. In line with A.S.T.E. progress and the healthy growth of our official publication, we've moved into new and bigger quarters; we've a *plant*, with adequate office and manufacturing space as well as room for future expansion.

Speaking for myself, I've had a lot to learn—and as much to unlearn. True, I'd been writing for years and, on several occasions, had even taken a fling at editing, and that, with the added experience of several terms as A.S.T.E. Editorial Ch'man, smoothed the transition from tool engineer to technical editor. But, my actual experience in the printing game had been confined to tooling up linotypes and printing presses—and, come to think of it, printing cloth in a textile plant. Oh, I've been around!

When first coming on the job, however, I must have been quite a trial to the typesetters and printers in the back room, especially as I had my own individualistic approach to the problems of publication. But, the boys put up with my idiosyncracies—even admitted that some of my ideas were good—and, from the printers devil to the top kick (who, incidentally, has put in a lick at precision tool work) gave me everything they had. Their unstinted cooperation is reflected in the high quality of the magazine.

If I'd only been born triplets! For it's an open secret that, by any reasonable standard of comparison, we have been under staffed for a magazine of our size. But, what we've lacked in numbers we've made up in the will to work, and slowly but surely—and by cut and try rather than by exact formula—we've laid an enduring foundation, solid enough to bear any future load.

In this connection, I want to put in a word for our advertising manager, Clarence Etter. When we first met, I was with Midland Steel Products, where he called as a salesman for a line of tools and made a very favorable impression. A plugger rather than a high pressure salesman, Clarence sells on the facts and on personal convictions of quality. And from what I hear, he is making as fine an impression on our clientele as he made on me at our first meeting. He wears well.

Two other men—Bud Wellman and Jack Osmer—are comparatively recent additions to the staff, but they, too, seem to be going over in a big way. Both men were assigned to the A.S.T.E. Directory which, at time of writing, is beginning to roll off the presses. I realize, of course, that you boys North, East, West, South have been looking eagerly forward to the Directory, yet, only those who have actually worked on it can even remotely appreciate the outright toil that has gone into its makeup. It's really been a job!

Just before moving, had a pleasant visit from Clayton P. Fisher, Jr., manager of the Press Relations Div'n of General Electric's Apparatus Dep't. Y'know, I've long had a warm spot in my heart for the press relations boys of the various companies. For one thing, they're swell guys (which is probably why they're picked for their jobs) and for another, they know their stuff.

But, there's still another reason. We hear a lot about "soulless corporations," and perhaps a corporation, by itself, is rather impersonal. But in the most of 'em are to be found people who, because of their personality and warm friendliness, tend to make them essentially human. And of these, the boys in Press Relations play a stellar role. And that is as it should be, considering that the average corporation is made up of a majority of small shareholders—the little fellows—whose interest in its success is just as keen as that of the highest ranking officer or director. So, for Press Relations, may their tribe increase!

Typical of many letters coming to hand, John A. Ritchel writes in to tell us how well he likes *The Tool Engineer*. "There is one thing I'd like to see," he says among other things, "that is, to separate the different articles so it would be easier to cut them out and file them under main headings. As it is, there may be something on gearing on one side (of a sheet) and the start or ending of something else on the other side. I think most of these articles are worth saving for future reference."

As the suggestion is in line with a number of others in similar vein, we're going to try it out, albeit a bit reluctantly. Y'see, we like to start a story on a left hand page, the idea being to get a symmetrical "spread," as we term it, across two pages. Yet, while we have been highly complimented on the artistic arrangement of *Tool Engineer* articles, this arrangement has the disadvantages outlined by Mr. Ritchel.

Beginning with this issue, therefore, and as far as layout permits, we're going to start articles on the right hand pages. This applies particularly to the Fundamentals of Tool Engineering, which have met with such an overwhelming response that we never seem to have enough tear sheets to meet the demand. By confining this feature to one sheet, it will be easier to cut out and file. The same will hold true for major articles, the whole facilitating makeup of reprints and the handling of tear sheets. The public be pleased!

Like the most of you, I've been looking forward to a new car, but with industry at a virtual standstill and deliveries on all makes from six months to a year away, all I can see is a car "in the future." So, I'm going to have my '40 model reconditioned and let the rest of the world roll by until everybody concerned gets hep to the idea that prosperity's going to stay around the corner until the country gets to producing.

As Sherman didn't say, this is a h—l of a war. Before the main fracas started, farmers were told to plow their crops under and to kill off meat on the hoof, so's to hold up prices; now, they're killing off the critters because there's no grain for feed. As a result, shoppers wend their weary way from empty meat counters to equally depleted stocks of tissue, which probably doesn't make any difference now that we're stymied coming and going. I tell you, it takes genius to make both ends meet, these days. But, "this too, will pass away," and speaking for myself, I still have an abiding faith in America's future.

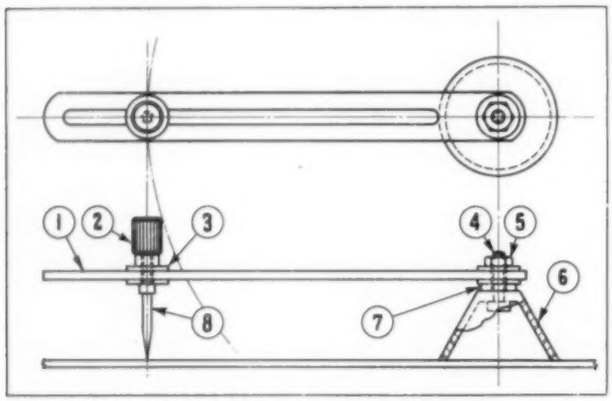
Andy

GADGETS

Ingenious Devices and Ideas to Help the Tool Engineer in His Daily Work

Suction Beam Compass

THIS "GADGET" is very useful for layout circles on sheet metal, plastics and other materials that must not be marred by center punch marks.



A standard commercial suction cup (Det. 6), made of good, live rubber, is used for the center. The component parts are C.R.S., except the scriber, which is made of drill rod and hardened. The scriber (Det. 8) is made so that it will slide, when positioned in the longitudinal slot shown in Det. 1, when unlocking Det. 2. The latter should have a straight knurl for easy turning.

Det. 1 is made of flat C.R.S. bar, with a hole reamed to its apex point. Det. 3 are standard washers ground flat. Det. 7 is a spacer to suit the required slip fit between Dets. 4, 3 and 1. Det. 4 is a threaded stud machined to suit the suction cup used.

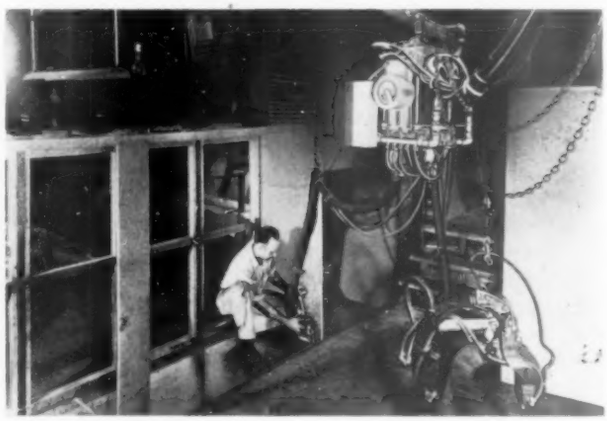
Frank J. Peragine
Greater New York Chapter.

Welding Cuts Costs

As indicative that resistance welding is not confined to high production is well illustrated in a recent article in *Western Metals*, of which this item is a condensation. A small California plant, engaged in the manufacture of specialized refrigerators and coolers, uses two welding guns operating from a single transformer, and with a single timer and air-hydraulic booster, to materially reduce manufacturing costs on these units.

The welder is a product of Progressive Welder Co., Detroit, and the entire assembly is mounted on a chain hoist which travels on an overhead trolley conveyor. Hence, the equipment can be moved over a wide area and raised and lowered at will for welding in different positions.

The transformer weight balances the two guns, both of which are of the scissor type, one short throated, the other deep throated to reach all joints of the work being assembled.

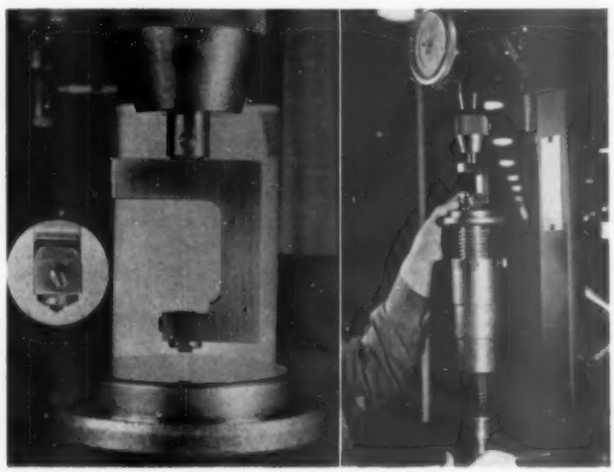


Carbide Edge for Checking Hardness of Small Bores

AN INTERESTING application of the use of cemented carbides in the field of hardness testing is a recent development by *Pratt & Whitney Aircraft Division* of United Aircraft Corp'n, at East Hartford, Connecticut. For several years, solid Carboloy balls have been used in Brinell machines, particularly for checking higher ranges where the extreme hardness of cemented carbides has insured greater accuracy of hardness determinations.

In the Pratt & Whitney Aircraft application, the use of Carboloy has made possible the checking of comparative hardness inside of small bores, and especially in the checking of hardness of threads in castellated aircraft engine nuts. The carbide is in the form of an "edge" penetrator mounted in a C-extension arm on a Rockwell machine, as shown in the composite photo at right.

The Carboloy penetrator has an obtuse angle with a .010" radius at the edge (see insert). The modified "C"-shaped steel holder is attached to a Rockwell machine, as shown at right. This arrangement enables the carbide "edge" to contact the internal threads of the nuts being checked. Since, however, conventional Rockwell scales—such as the "B" or "C" scales—cannot be used, the readings obtained are purely relative and the scale used is based on readings taken from checks of both acceptable and non-acceptable threads. The use of a carbide edge penetrator prevents indenting or nicking of the testing "edge," as would be the case if steel were used in a similar manner.



GOOD READING

A Guide to Significant Books and Articles of Interest in the Trade Press

MACHINE TOOLS, by Guy Hubbard in May 6 *Steel*, summarizes the recent A.S.T.E. New Era Exposition, in Cleveland, as not only well named but well timed. The writer declared himself deeply impressed by the rapid progress and broad scope of the modern tool engineers, and by the extent to which they influence manufacturing progress. Also reviewed, is the Westinghouse Machine Tool Electrification Forum, April 9-10 in Pittsburgh, and the spring meeting of the Nat'l Machine Tool Builders Ass'n, April 15-17 in Atlantic City. While the latter meeting was mainly concerned with the tremendous surplus of government owned machine tools, Mr. Hubbard's impression, of the three meetings, was that they tended to direct industry from prewar to postwar ideas.

OBSERVATIONS ON THE IMPACT STRENGTH OF ALLOY STEELS HARDENED FROM CYANIDE BATHS, by Sidney M. Lenhoff and Louis F. Roth in May *Metal Progress*, presents tabular data and information on the impact properties of S.A.E. 6140 Steel which has been heated in cyanide.

The co-authors concluded that, where wear resistance is the important requirement, cyanide heat is acceptable, but if impact is also present, it is best to proceed with considerable caution. Although cyanide appears to embrittle parts made from S.A.E. 6140, it is still used as a heating medium for the lack of something better.

SAMPLING INSPECTION PLANS FOR CONTINUOUS PRODUCTION WHICH INSURE A PRESCRIBED LIMIT ON THE OUTGOING QUALITY, by A. Wald and J. Wolfowitz, is a reprint of their article on "several plans for sampling inspection of manufactured articles which are produced by a continuous production process," which originally appeared in the March, 1945, The Annals of *Mathematical Statistics*.

This scholarly article, complete with several mathematical proofs, is a 20-page discussion of plans "applicable to articles which can be classified as 'defective' or 'non-defective' and which are submitted for inspection either continuously or in lots."

BERYLLIUM COPPER, by H. G. Williams in May 13 *Steel*, states that although beryllium copper master alloy costs $15 per pound, this high cost has not "hindered a wide use of the alloy, especially in light parts where metal cost is a small element in the cost of the finished component." High costs, according to Mr. Williams, are due to the difficulty of extracting beryllium from the ore, some of which is found in the U. S. and Canada although the most important commercial sources are Brazil and Argentina. It is not unusual, the author reports, "to handle 100 tons of rock to obtain ½ ton of beryl which, in turn, contains only about 5 per cent beryllium."

Mention is made of the fact that beryllium copper is nonmagnetic, has the corrosion resistance of pure copper together with a high degree of electrical conductivity. The article concludes by explaining several uses for the "wonder metal," as it was once called. These include use in solenoid guides, precision coiled springs, pressure diaphragms, radar parts, springs for electrical switches and relays.

BEARING FAILURES—CAUSES AND CURES, by R. W. Dayton and R. E. Adams in May *Machine Design*, details the mechanism of hydrodynamic lubrication where continuous movement is involved. It is the first part of a two-story series. A list of 19 references concludes the article and should prove of value to the reader who desires further "detailed information essential for utilizing what is known of bearings." The second and final article will deal with "the performance of bearings having partial lubrication . . . both continuous movement and reciprocating movement . . . with emphasis on the prevention of failure due to galling and wear."

CONTINUOUS CASTING OF ALLOY BEARING STRIP, by T. W. Lamb and E. C. Jeter, in June *Materials and Methods*, discusses the wartime shortage of tin, and later of cadmium, and how use was made of copper-lead alloy bearings as a desirable substitute for bearings. The authors, who are connected with the Ford Motor Company Chemical Engineering Department, discuss the use of this type of bearing metal in the floating type of bearing for several applications in Ford cars and trucks.

TOOLS FOR USE IN BENDING MACHINES, by E. J. DeWitt and Harry S. Nachman, in May *Machinery*, discusses forms, clamping dies, stationary pressure dies, and shoes used in connection with bending machines for pipe, tubes, and other metal shapes. Subsequent articles in the series—of which this is the second—will discuss the hydraulic circuit for tube bending machines and important factors to be considered in designing work for bending.

COMBINED MAINTENANCE AND TOOL DEPARTMENTS, by D. G. Baird, and **IMPROVING TOOLROOM CONTROLS,** by Donald H. Sunderlin, both in May *Mill and Factory*, emphasize the need for close cooperation between related departments in factory organization. Both articles also give specific methods for improving the quality of toolroom output.

The article by Mr. Baird explains the manufacturing reorganization recently completed at American Blower Corp'n, Detroit, wherein they have combined the maintenance and tool departments, with a division manager in charge. Since about 60 per cent of the work in their toolroom was maintenance, including a large amount of die repair, the other 40 per cent toolmaking, the new combination has made for more successful operation.

In the second article, by Mr. Sunderlin, the author brings out that although toolmakers are ofttimes exempt, in some plants, from the controls that produce beneficial results when exercised over other departments, special rules applying only to the toolroom may be a disturbing factor in employee relations with other departments.

RECOMMENDED PRACTICES FOR RESISTANCE WELDING, published by the *American Welding Society*, 33 W. 39th St., N. Y. 18, (50c) is a compilation of recommended practices for spot and seam welding of low-carbon, stainless and hardenable steels, nickel, monel and inconel; the projection welding of low-carbon and stainless steels; flash-butt welding of low and medium forging strength steels, and standard methods for testing resistance welds.

BULLETINS AND TRADE LITERATURE

Items briefed herein have been carefully selected for their interest and application. Unless otherwise stated, all are available, free, from the stated sources.

HARDINGE BROTHERS, INC., Elmira, N. Y., present a 7-page *Bulletin DV59,* giving information on their new 36" Hardinge DV59 High Speed Precision Lathe. Features include hardened ground steel dovetail ways, center-drive preloaded ball bearing headstock, patented improved compound slide rest, and welded steel pedestal with knee space.

A new 48-page booklet, *Accessories and Attachments,* by the **GIDDINGS & LEWIS MACHINE TOOL CO.,** Fond du Lac, Wis., makes it easy to locate the most effective attachment or accessory for handling jobs on G. & L. Horizontal Boring Machines. Information is separated in box form and tells how, when and where to use each item listed. Illustrations of the individual accessory and attachment are shown together with an operation photograph of the equipment.

Meehanite Quality Control Assures Uniform Dependability, is a new bulletin of the **MEEHANITE RESEARCH INSTITUTE,** Pershing Square Bldg., New Rochelle, N. Y. The four-page bulletin briefly describes the metallurgy of Meehanite and contains a complete tabular summary of engineering characteristics of various types of Meehanite castings.

Motor Service Plans is a 12-page pamphlet of **WESTINGHOUSE ELECTRIC CORP'N,** Box 868, Pittsburgh 30, listing three plans to provide 100% service coverage for all fractional hp motors: (1) The motor exchange plan provides "over the counter" service for specified sizes and types of standard and special fractional motors. (2) The shop repair plan is a service for special, semistandard, noncurrent and competitive types of motors. (3) The national service plan sets up individual service policies for those manufacturers who wish to retain direct control of all field service activities.

PHYSICISTS RESEARCH CO., Ann Arbor, Mich., has issued its *1946 Profilometer Catalogue* describing its equipment and accessories for measuring surface roughness. Besides information on the profilometer itself, the catalogue contains suggestions on the quality control of surface finish and on the designation of surface finishes on prints and specifications.

A leaflet—*Spline Gages*—by **WALTHAM GAUGE CO.,** 9114 E. Forest Ave., Detroit 13, describes their line of involute, straight and serrated gages.

The Hydraulic Press is a 38-page story of the varied uses to which the products of **THE HYDRAULIC PRESS MFG. CO.,** Mount Gilead, Ohio, have been put. The booklet's text and pictures are keyed in a step-by-step presentation of applications for producing molded plastic parts, closed and flat die forgings, parts for jet airplane engines down to the forming of rawhide hammers.

Catalog No. 15, by **FARRIS ENGINEERING CO.,** 400 Commercial Ave., Palisades Park, N. J., covers new designs and improvements on older models of Farris safety and relief valves. A pictorial index, showing line drawings of all basic *valve types,* providing for selection without thumbing through the entire catalog.

Hastelloy, a 40-page publication of **HAYNES-STELLITE CO.,** Unit of Union Carbide and Carbon Corp'n, Kokomo, Ind., describes Hastelloy nickel-base alloys which have been developed to withstand corrosive action of the common mineral acids, such as hydrochloric and sulphuric, over a wide range of temperatures and concentrations, and to resist oxidizing agents such as ferric chloride and wet chloride. The booklet includes information on the physical and chemical properties of these alloys, and how and where they can be economically used.

TAILORING IN METAL, a 19-page booklet by *The United Welding Co.,* Middleton, Ohio, discusses such factors as cost, weight and strength affecting the choice of welded fabrication. Also covered are various techniques of welded design as applied to such products as gear blanks, pulleys, tanks, casings, housings, frames, breechings and stacks.

Swaging Machines is a new catalogue of the **STANDARD MACHINERY CO.,** Providence, R. I., giving details on their complete line of swagers for pointing and sizing, and also listing specifications of their new cable and hydroformer types for metal shaping and the attachment of fittings to bar, cable and tube.

Magnetic Holding Methods, a 23-page booklet by the **ROCKFORD MAGNETIC PRODUCTS CO.,** 1302 18th Ave., Rockford, Ill., describes their line of Power-Grip chucks, ranging from 60 to 200 watts. Other products include a multiple pole and a two-pole rotating chuck, a 200-pound capacity 6 volt d.c. hand lift magnet, and a 6 volt hoisting magnet.

Majestic Drill Sharpener, a leaflet of the **MAJESTIC DRILL SHARPENER CO.,** 1100 2nd Ave. So., Minneapolis 2, describes their sharpener and control dial for use on drills from 5/32" to 1" with straight or No. 2 taper shank.

SAPPHIRE PRODUCTS DIV. of Elgin Nat'l Watch Co., 932 Benton St., Aurora, Ill., has published a leaflet on *Elgin Sapphire Products,* describing their sapphire plug and ring gages, and gage accessories, and also featuring many other uses of sapphire where a gaging material of high dimensional fidelity is demanded.

North East West South in Industry

Anton P. Joen has been put in charge of the recently opened Detroit offices of the *Cosa Corporation*, located at 307 Boulevard Bldg. The Company, with headquarters in the Chrysler Bldg., New York, is American representative for a number of Swiss makers of precision tools. These include Maag, Micro-Maag, Makron, Societe Genevoise D'Instruments de Physique Studer and others.

Lucille Bell, formerly an Assistant Editor, *Steel* magazine, Cleveland, has been appointed Advertising Manager of the recently organized **WASHINGTON STEEL CORP'N**, Washington, Pa., according to T. S. Fitch, President. The feminine gender is such a stranger to this column that we take pleasure in wishing Miss Bell success in her new venture.

Formation of the **WALES-STRIPPIT of CANADA, LTD.**, 85 Cannon St., West, Hamilton, Ont., with **William Beattie** as Manager, has been announced by George F. Wales, President. Beattie will now be able to give direct Canadian service on Wales Hole-Punching and Notching Equipment which was formerly handled from the main plant in N. Tonawanda, N. Y.

Arne Hedstrom is in charge of the new Indianapolis office of the **VANADIUM-ALLOYS STEEL CO.**, Latrobe, Pa., located at 243 East Ohio St. A graduate of the Carnegie Institute of Technology, Mr. Hedstrom was formerly with the company's Chicago office, leaving to enter the Army where he served with the Engineers.

GEORGE GORTON MACHINE CO., Racine, Wis., has announced the appointment of **Ira R. Ogilvie** as Sales Promotion and Advertising Manager. Previous to his release from the Army, Mr. Ogilvie was a merchandising consultant, analyst and writer, and is now planning expanded advertising and sales promotion for the company.

E. G. Hardig has been reappointed sales representative, Michigan territory, with headquarters in Detroit, for the **NATIONAL TOOL CO.**, Cleveland. With National Tool for fifteen years, and widely known in the sales field, Mr. Hardig served the Michigan area until '43 when, due to war demands, he was drafted to serve as general Sales Manager at the Cleveland office. He is a member of Detroit Chapter, A.S.T.E.

E. C. Bullard (right) has been made President and General Manager of **THE BULLARD CO.**, Bridgeport, Conn. Formerly vice-president and general manager, he succeeds **E. P. Bullard** (left), retired to become Chairman of the Board. The new Assistant General Manager is **E. P. Bullard, III**, who also retains his title of Vice-President. **G. L. Todd** keeps his position as Comptroller and has been made a Vice-President.

Gwilym A. Price (right) has been elected President, **WESTINGHOUSE ELECTRIC CORP'N**, succeeding **George H. Bucher**, resigned to become Vice-Ch'man of the Board, the while continuing as Ch'man of Westinghouse Electric International Co. **A. W. Robertson** has been elected Ch'man of the Westinghouse Board of Directors, and **L. E. Osborne** (left), who joined the company at the age of 16 as a tool room clerk, has been named senior operating Vice-President responsible to the president for all manufacturing units of the company.

William T. Muirhead (right) was recently elected Executive Vice-President of **THE WICKMAN CORP'N**, with full responsibility for all manufacturing operations. **Axel C. Wickman** was named President of the corporation, succeeding **H. Mandel**, resigned to take over a special assignment for the parent company, A. C. Wickman, Ltd., Coventry, England.

H. L. Grapp succeeds **A. E. Grapp**, recently elected Ch'man of the Board, as President and Gen'l Mgr. of **DESPATCH OVEN CO.**, Minneapolis. Other changes include **F. H. Faber**, made Exec. Vice-Pres. and Gen'l Sales Mgr., **G. M. Lund**, Vice-Pres. and Sec'y, **C. P. Doherty**, Factory Mgr., and **Lloyd Johnson**, Shop Sup't.

Gilbert L. Dannehower, general manager of the Johansson organization in the U. S. until that concern was purchased by Henry Ford, has established the **HIGH PRECISION PRODUCTS CO.**, Westfield, N. J., to serve as a consulting engineering service on high precision work. It will also handle the exclusive sale, in New Jersey, Eastern Pennsylvania, Delaware and the District of Columbia of the products of the Societe Genevoise De Instruments De Physique, Sip (Swiss Jig Borers), Maag Gear Grinders, Bechler Automatics, Mikron Machines, Studer Profile Grinders, and Safag Gear Hobbing Machines.

GEAR STEEL CHIPS at - - -

..... 1½ lbs. a minute

Actually the job only took 50 seconds: To produce the 7 inch PD gear (left) from the forged blank (right).

That's the kind of performance which you can get only from the Michigan SHEAR-SPEED, which cuts all teeth simultaneously.

The 6-pitch gear above, with its 42 teeth of 1¼ inch face width was cut with just 82 strokes of the SHEAR-SPEED. Metal removed in those 50 seconds weighed 22 ounces.

That's Speed! Speed which makes the SHEAR-SPEED the first gear cutting machine equal to Michigan gear finishing machines in productivity per machine hour. And the gears produced are the equals in precision to gears cut in production by any gear cutting process.

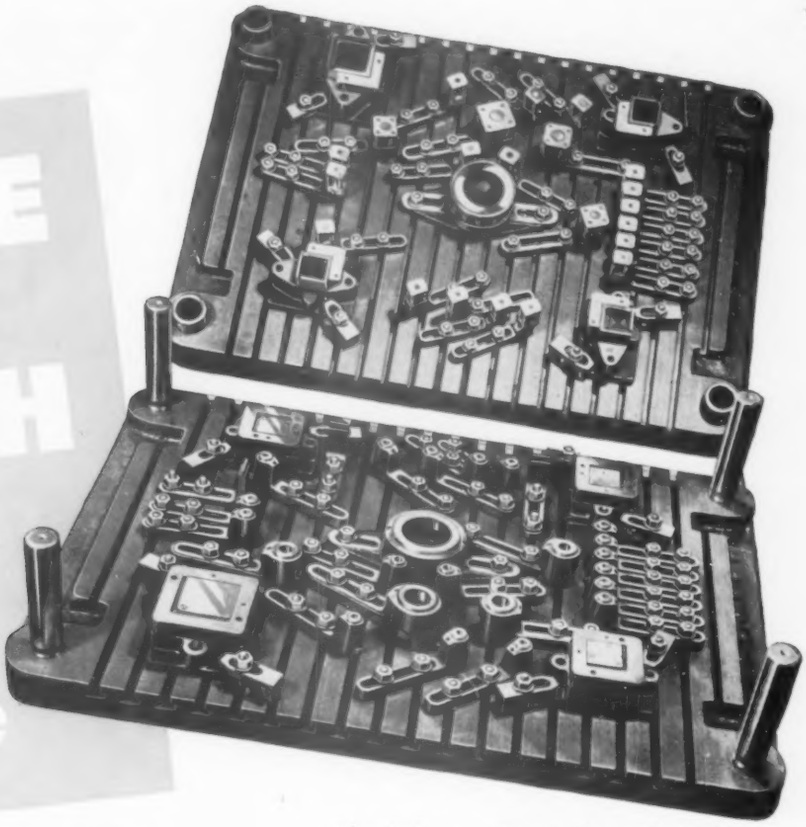
Michigan SHEAR-SPEED gear shapers are now available in a variety of standard sizes. For further information, write for Bulletin #1800-45.

ORIGINATORS of GEAR SHAVING

MICHIGAN TOOL COMPANY

7171 E. McNICHOLS ROAD DETROIT 12, U. S. A.

PIERCE and NOTCH at the same time



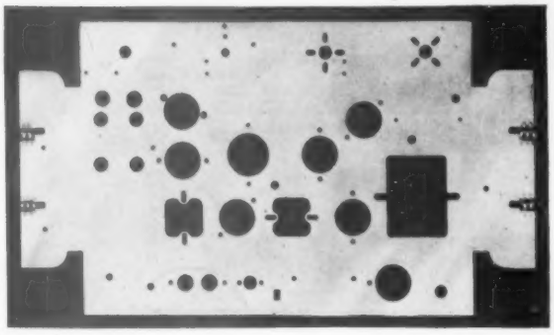
A typical set-up for notching and piercing.

with

WHISTLER

MULTI-USE Adjustable Dies

Pierced and notched with Whistler multi-use adjustable dies.



You save press time and speed production by combining corner notching dies and group dies in the same set-up with adjustable piercing dies. Press operations are reduced to a minimum. Engineering changes effecting relocation or sizes of holes can be made without delay right on the press.

Whistler multi-use adjustable dies are available from stock... a day or two from your plant ...in all standard sizes from 1/32" to 3" diameters...round, square, ovals and rectangles. Notching and group dies to order. In addition to mighty attractive savings in original die costs there is this important advantage of eliminating weeks of production delay.

Re-arrange Whistler multi-use adjustable dies in as many different set-ups as your production calls for... you actually make up die sets from units in stock and reduce costs per job to an unbelievably low figure. All parts of like size are interchangeable.

Get all the facts on how Whistler adjustable dies can speed *your* production... cut *your* costs. Write today for the Whistler Catalogs.

S. B. WHISTLER & SONS, Inc.
752-756 MILITARY ROAD BUFFALO 17, N. Y.

WHISTLER MULTI-USE ADJUSTABLE PERFORATING DIES

. . . when it comes to precision finishing HEALD can help you do it better . . . and at lower cost!

With costs rising all along the line, you've got to get the most out of your machine tools if you're going to produce at a profit. That's where Heald engineering comes in—pointing the way to more economical production . . . to simplified set-ups and automatic control . . . with the very latest equipment for precision finishing, by grinding or borizing.

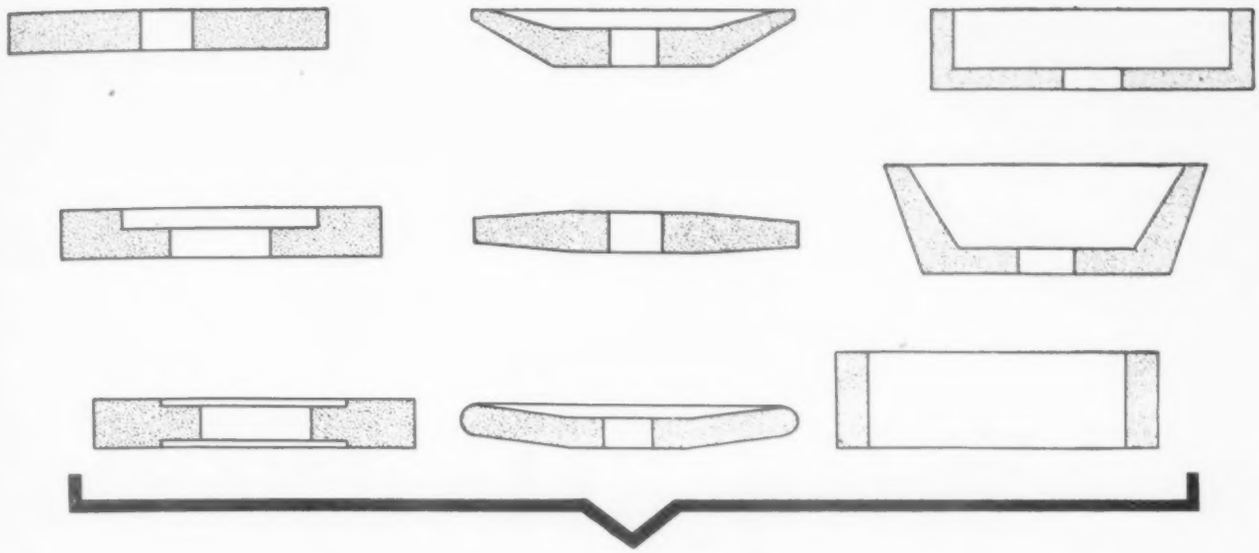
Here, for example, is how one manufacturer gained by bringing his problem to Heald. He had cylinders that required boring, turning, chamfering, and facing. It looked like a job for twelve lathes . . . until Heald engineers showed him how to get a better production rate with just two Bore-Matics. Result: he saved 40% in equipment cost, 83% in floor space, 90% in man-hours . . . a total saving of 60% in the cost of the finished product!

Such savings are being made and can be made when you put Heald machines on your production line. And it makes no difference whether you operate a small shop or plant employing hundreds of workers—Heald's staff of 200 engineers is always ready to help you find new ways of improving your production and cutting your costs. For further information, write: The Heald Machine Company, Worcester 6, Mass.

HEALD

means more precision . . . less cost

INTERNAL AND SURFACE GRINDING MACHINES • BORE-MATIC PRECISION FINISHING MACHINES



Sometimes a different shape determines better grinding

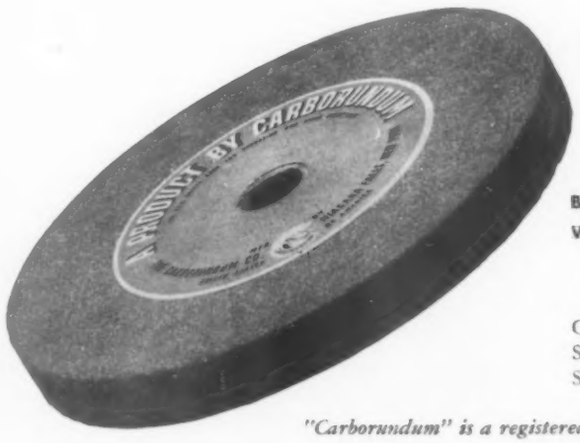
In terms of grinding wheel life, as well as efficiency and economy—the wheel shape selected for a specific operation is worth careful consideration. This is equally true for both production operations and tool-room grinding.

To help you check your grinding operations . . . to assist in selecting the best combination of shape, grit, grade and bond, follow the simple plan of many top notch production men. Consult with your CARBORUNDUM salesman or our distributor's representative. Many customers consider his opinions of real, practical value. His suggestions are based on a knowledge of latest abrasive developments . . . supported by daily experience with plenty of on-the-job grinding applications.

If the problem is unusually difficult, the CARBORUNDUM representative may call in an Abrasive Engineer for consultation. Both representative and Abrasive Engineer have available to them the facilities and resources of the world's most noted abrasive laboratories.

Through this single practice, of calling in CARBORUNDUM, you can be sure of getting maximum efficiency from your grinding wheels and other abrasive products. The Carborundum Company, Niagara Falls, New York.

A good rule for good grinding . . . **CALL IN**



CARBORUNDUM

TRADE | MARK

BONDED ABRASIVES

WHEELS
- Silicon Carbide
- Aluminum Oxide
- Diamond

Cylinder Hones
Sticks, Stones & Rubs
Specialties

COATED ABRASIVES

Paper, Cloth and Combination
Sheets, Rolls, Discs

ABRASIVE GRAINS AND COMPOUNDS

for:
- Polishing
- Lapping
- Pressure Blasting
- Finishing

"Carborundum" is a registered trademark which indicates manufacture by The Carborundum Company

Simplify

WITH BETHLEHEM'S BIG 8 TOOL STEELS

The BIG 8 Family

Carbon Tool Steel
(water-hardening)

Tool Room (BTR)
(oil-hardening)

Omega
(maximum shock-resistance, cold work)

No. 67 Chisel
(high shock-resistance, both hot and cold work)

Air-Hardening
(low distortion during heat-treatment)

Lehigh Die & Tool, H Temper
(high-production die steel)

No. 57 Hot Work
(maximum red-hardness in hot work)

No. 66 High Speed
(general-purpose high-speed steel)

Because the Big 8 will do some 90 per cent of your tool-steel jobs—and do them superlatively well.

Because it is easy to learn their properties, their applications, their personalities.

Because there isn't a "fussy" steel in the group.

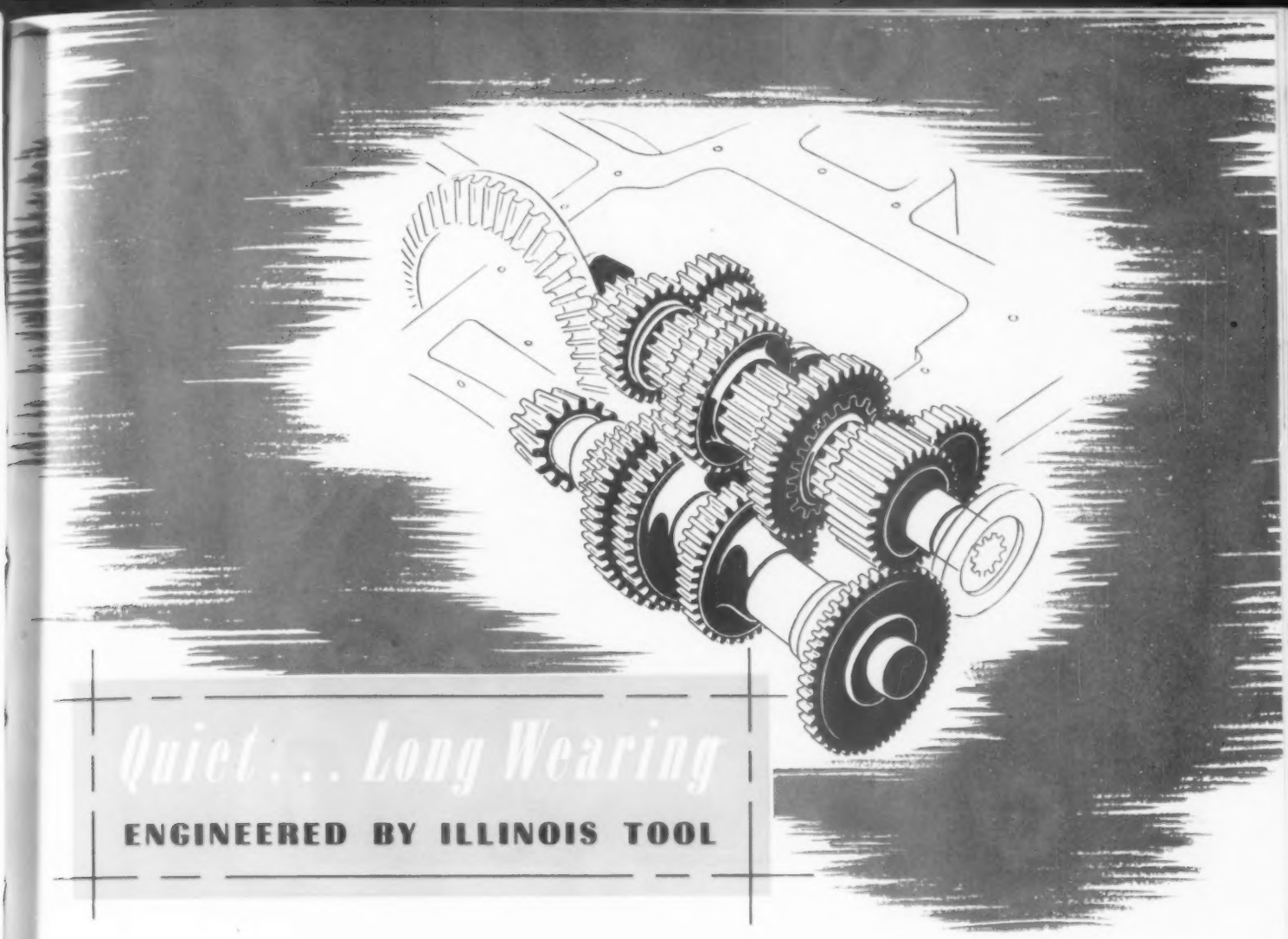
It all boils down to this:

The average toolroom no longer needs to maintain a wide and confusing assortment of one-purpose steels. Not with Bethlehem's Big 8 in stock. The Big 8 group is small, compact . . . easy to heat-treat, easy to handle . . . and amazingly versatile.

Use these steels to the fullest advantage. Be sure you acquaint yourself with *all* their uses. That's your opening step in a program of simplified toolroom practice. *Write for your Big 8 Kit—a set of booklets on these versatile tool steels.*

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

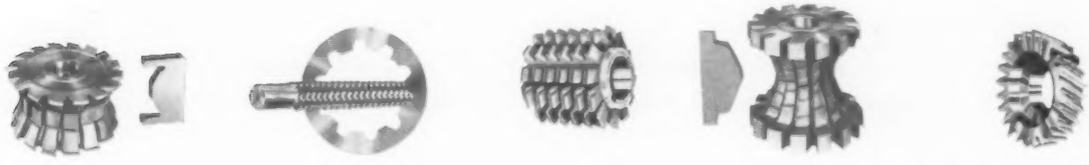
★ ★ ★ BETHLEHEM STEEL ★ ★ ★



Quiet . . . Long Wearing

ENGINEERED BY ILLINOIS TOOL

Having designed and made hobs for producing all types of gears in practically every industry, our engineers are ready to help you solve such important problems as tooth design, proper checking procedures and machining methods.



Overnight to all America from the hub of air transportation.

HEADQUARTERS FOR ENGINEERED CUTTING TOOLS

ILLINOIS TOOL WORKS

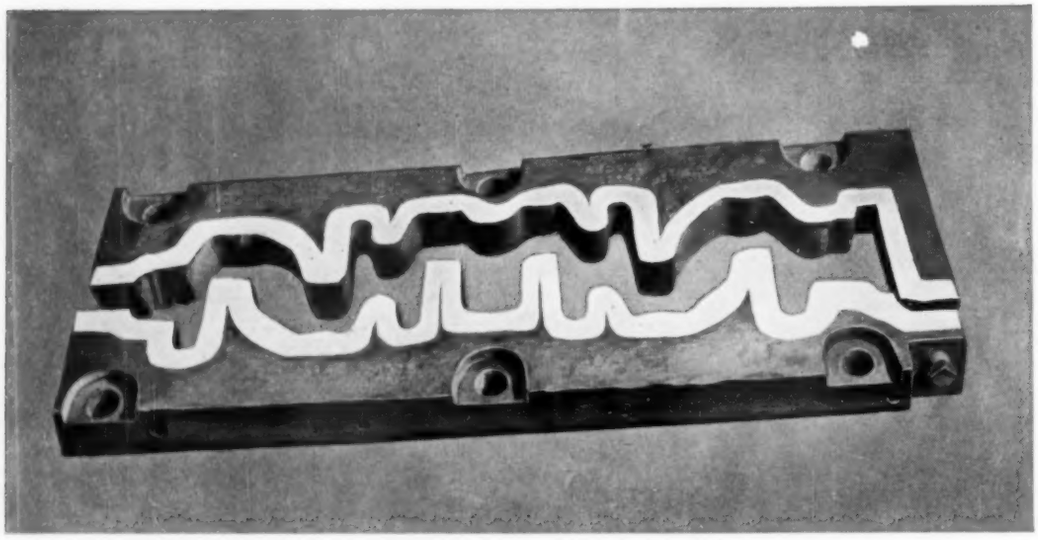
2501 N. Keeler Avenue, Chicago 39, Illinois

In Canada: Canada Illinois Tools, Ltd., Toronto, Ontario

MANUFACTURERS OF METAL CUTTING TOOLS AND SHAKEPROOF PRODUCTS

HAYNES STELLITE Rod

Makes Dies Last Longer and Saves Refitting Time



This crankshaft trimming die is hard-faced at points of wear with HAYNES STELLITE No. 6 rod. It trimmed from 150,000 to 155,000 pieces before it was returned to the die shop for touching up. Before the practice of hard-facing these trimming dies was adopted, they produced less than 500 pieces before it was necessary to refit them.

HAYNES STELLITE alloy increases the life of all types of dies because it resists abrasive wear even on hot work. Maintenance costs are reduced—as dies have to be changed less frequently, and, also, you can refit a hard faced die in less time than is required for refitting a plain steel die.

For further information on savings that can be made by hard-facing with HAYNES alloys, write for the 100-page book, "Hard-Facing With Haynes Stellite Products."

HAYNES STELLITE COMPANY

Unit of Union Carbide and Carbon Corporation

UCC

General Offices and Works, Kokomo, Indiana

Chicago—Cleveland—Detroit—Houston—Los Angeles—New York—San Francisco—Tulsa

HAYNES alloys

TRADE-MARK

The registered trade-marks "Haynes" and "Haynes Stellite" distinguish products of Haynes Stellite Company.

PROBLEM: Manufacturer of hydraulic pressure system pumps for 3000-psi service sought a hydraulic oil that (1) would resist oxidation at the 135° F. pump-operating temperature; (2) could be safely used for run-in test purposes; and (3) would have inherent rust-preventive qualities so it could be used as a "shipping" oil.

SOLUTION: When the Shell Lubrication Engineer studied the problem, he recommended a Shell Tellus Oil. The specifications of this oil satisfied the pump maker on points (1) and (2), but he was skeptical of the rust-preventive qualities. A "storage" test was made, and, when Tellus-filled pumps were inspected, no sign of rusting was found. Convinced, the pump maker now uses Shell Tellus Oil exclusively.

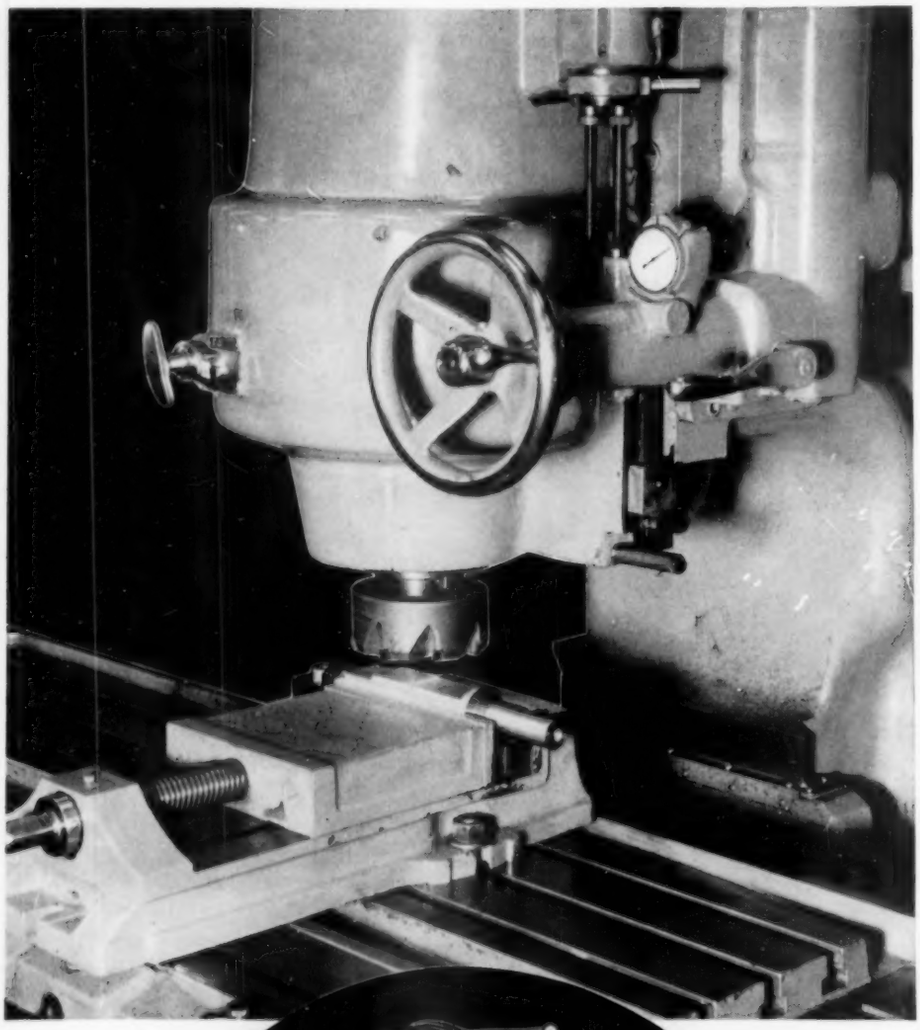
CONCLUSION: It pays to consult the Shell Lubrication Engineer, regardless of the nature or size of your lubricating problem. Write for informative literature on Shell Hydraulic Oils. Shell Oil Company, Incorporated, 50 West 50th Street, New York 20, New York; or 100 Bush Street, San Francisco 6, California.

SHELL HYDRAULIC OILS

SHELL

STAINLESS STEEL MILLING

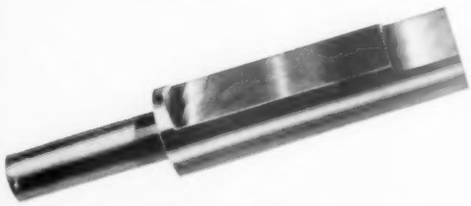
Made easy on a Kearney & Trecker CSM



THE JOB

Stainless steel is difficult to mill under almost any circumstances—but this super-powered CSM, equipped with the proper cutter literally "walked through" this job.

OPERATION:	Rough Mill Stud
MATERIAL:	Stainless Steel
CUTTER:	6" Dia.; 8 Tooth
TABLE FEED:	21 IPM
SURFACE SPEED:	346 SFM
DEPTH OF CUT:	.441" (Max.)
FEED PER TOOTH:	.020"
MILLING TIME:	26 Seconds



STAINLESS STEEL STUD

Note the excellent finish obtained despite the high rate of metal removal. The milling time of 26 seconds includes both surfaces. Micrometer stop dial indicator on machine facilitated this step milling operation.

• • •

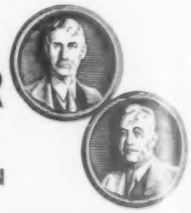
CSM Milling Machines were designed to obtain the greatest benefits from modern cutting tools, and are now part of our line of standard models. The design has been stabilized after complete analyses of industry's problems of milling with carbide cutters.

Because they are knee type machines, they are readily adaptable to a great variety of work. They are precision built in accordance with long established Kearney & Trecker standards, and will cut metals faster and to finer tolerances and superior finishes than ever before, with high speed steel cutters as well as carbide cutters.

CSM machines are available in 20, 30 or 50 H.P. models in both plain and vertical knee types.

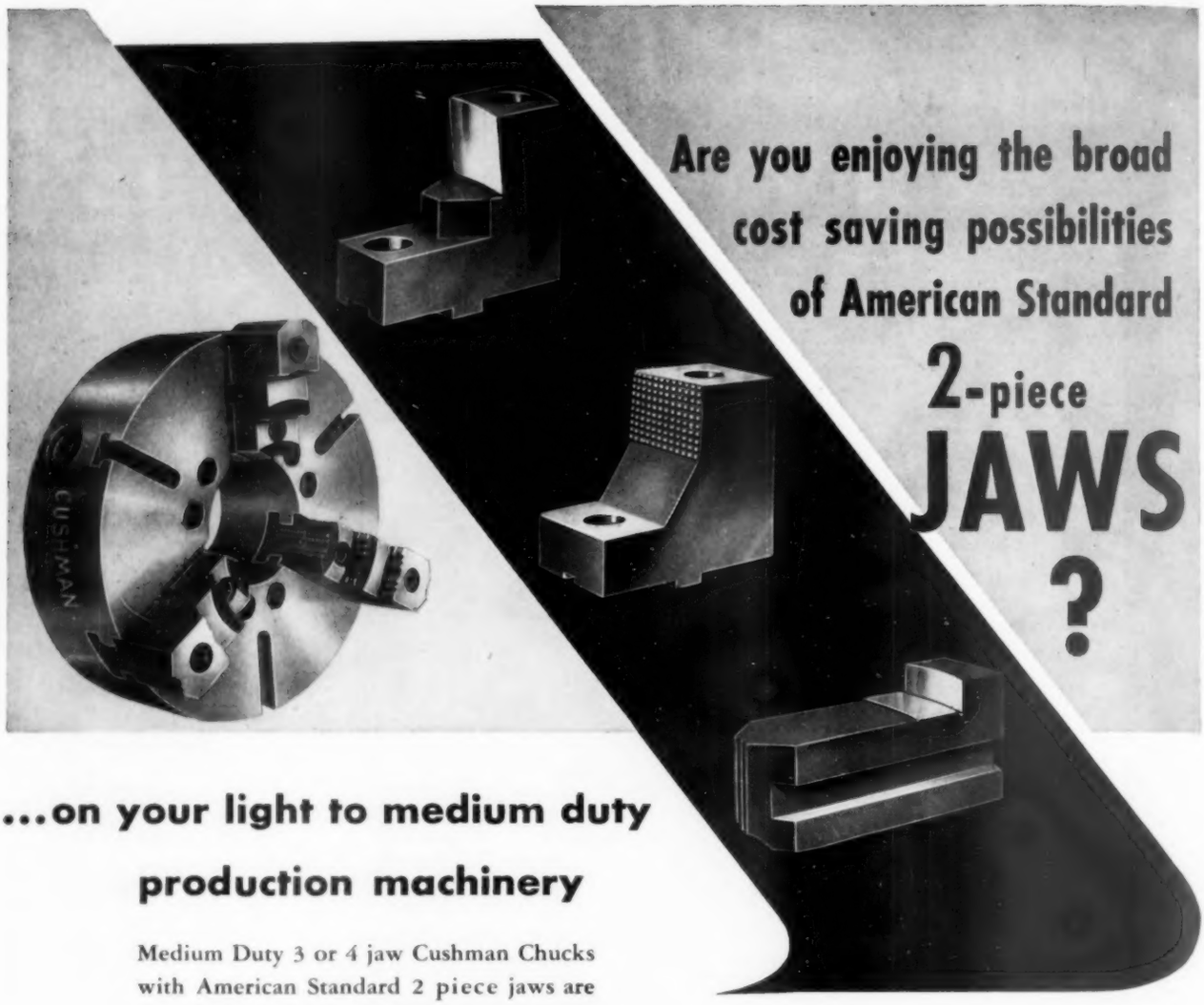
30 HP Plain CSM

Write for complete data on CSM machines — CATALOG CSM-20. Please indicate your business connection.



KEARNEY & TRECKER
CORPORATION
MILWAUKEE 14, WISCONSIN

BE READY FOR TOMORROW . . . WITH CSM'S



Are you enjoying the broad cost saving possibilities of American Standard 2-piece JAWS ?

...on your light to medium duty production machinery

Medium Duty 3 or 4 jaw Cushman Chucks with American Standard 2 piece jaws are the ideal equipment for your tool room lathes, your general purpose lathes and the great majority of lathes in your production departments. Because, with this type of jaw, you remount the top jaws when changing from one form of work piece to another... rather than using expensive work holding fixtures.

With this type of jaw equipment you can make full use of soft blank top jaws. These can be formed to hold all kinds of irregular shaped work pieces. And the cost will be far less than for special face plates or fixtures. With Cushman high standards of precision in chuck manufacture you can depend upon the accuracy of these set-ups for your most exacting work.

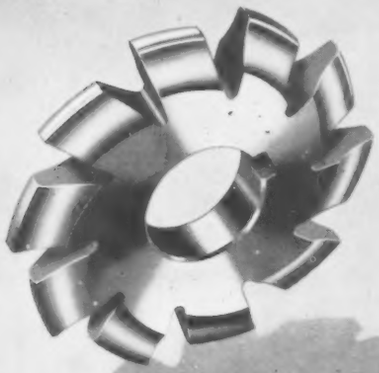
Our Engineering Department will be glad to give you further information and help on your own particular problems. Write us, without obligation.

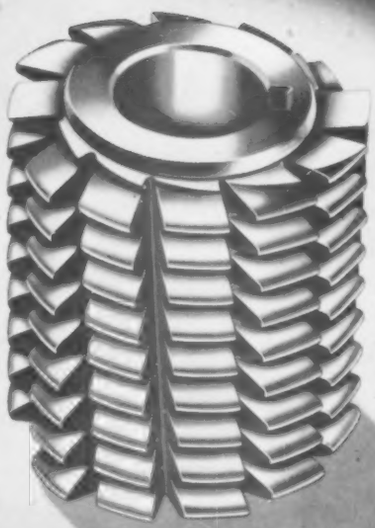
THE CUSHMAN CHUCK CO.
Hartford 2, Conn.

A WORLD STANDARD FOR PRECISION

CUSHMAN CHUCKS

FACTS about HOBS and GEAR CUTTERS





Call Your **DISTRIBUTOR!**

Leading distributors in every section of the country have complete stocks of National Cutting Tools. Every National distributor has a factory trained man to serve you. Call your National distributor for cutting tools or any staple industrial product.

Hobs are used for cutting various types of gears, such as spur, spiral, worm, and involute gears, and spline shafts, and for a number of similar applications, where large quantities are to be produced. Single type Gear Cutters are used for small quantity short run jobs where the expense of hobs are not warranted.

NATIONAL makes a complete line of gear cutters and hobs, for every application. All are of the same high standard that has made NATIONAL tools the National choice.

NATIONAL

NATIONAL TWIST DRILL & TOOL — ROCHESTER, MICH., U.S.A.

TWIST DRILLS
REAMERS, HOBS
MILLING CUTTERS
COUNTERBORES
SPECIAL TOOLS
END MILLS

TWIST DRILL AND TOOL COMPANY

ROCHESTER, MICH., U.S.A.

Tap and Die Division — Winter Bros. Co.

Factory Branches • New York • Chicago • Detroit • Cleveland • San Francisco • Distributors in Principal Cities

Emblematic OF NEW HORIZONS

Our HOUSEMARK is emblematic of designer and manufacturer of Special and Hydraulic machinery, hydraulic power and test units, hydraulic presses. . . . Moving machinery and equipment . . . some of it new, some of it that has been in two of our other plants . . . into a new building in Dearborn (main plant), provides us with more than double the facility and truly opens new horizons to "HY-MAC" . . .

While this company is comparatively young in years, our "key" men in the various departments are old in experience and have a combined "know how" comparable to any in the field . . . Send us a print of a part that is to be processed, together with the production requirement and our engineering department will make recommendations and preliminary proposal without obligation.

HYDRAULIC MACHINERY, INC.

12825 FORD ROAD — **Dearborn, Michigan**

HYDRAULIC MACHINERY—Western Division — **Glendale, California**

Also send for eight page brochure which completely outlines our facilities.

MOLYBDENUM-TUNGSTEN HIGH SPEED STEEL

is available from the mills listed below. Each brand name represents a steel that is made according to a genuine MO-MAX formula.

ALLEGHENY LUDLUM STEEL CORP. . . "LMW"
ATLAS STEELS, LIMITED . . . . . "MOHICAN"
BETHLEHEM STEEL COMPANY . . . . . "BETHLEHEM HM"
BRAEBURN ALLOY STEEL CORPORATION . "MO-CUT"
CARPENTER STEEL COMPANY . . . . . "STAR MAX"
COLUMBIA TOOL STEEL COMPANY . . "MOLITE M-1"
CRUCIBLE STEEL CO. OF AMERICA . . "REX T-MO"
HENRY DISSTON & SONS, INC. . . . . "DI-MOL"
FIRTH-STERLING STEEL COMPANY . . . "HI-MO"
HALCOMB STEEL COMPANY . . . . . "REX T-MO"
JESSOP STEEL COMPANY . . . . . "MOGUL"
LATROBE ELECTRIC STEEL COMPANY . . . . "TATMO"
ST. LAWRENCE ALLOYS, INC. . . . . .
SIMONDS SAW & STEEL COMPANY . . . . . "S.T.M."
UNIVERSAL-CYCLOPS STEEL CORP. . . . . "MO-TUNG"
VANADIUM-ALLOYS STEEL COMPANY . . . "8-N-2"
VULCAN CRUCIBLE STEEL COMPANY . . . . "VUL-MO"

FOR THE FULL STORY ON MO-MAX high speed steels—their physical properties, their advantages, and how to heat treat them—write today for the new, revised MO-MAX Handbook.

★ ★ ★

THE CLEVELAND TWIST DRILL COMPANY • 1242 East 49th Street • Cleveland 14, Ohio

HIGHER PRODUCTIVITY

through the FLEXIMATIC METHOD*

A KINGSBURY AUTOMATIC INDEXING FLEXIMATIC *

MAKES THE PART—A CAST IRON WORM GEAR BLANK

COMPLETING 7 MACHINING OPERATIONS

IN 14.2 SECONDS

Higher second operation production of cast iron worm gear blanks was the immediate result of the application of Kingsbury multiple machining methods. The *Kingsbury Fleximatic* illustrated consists of eight *standard* Kingsbury drilling heads mounted on a *standard* Kingsbury base equipped with an eight station automatic indexing turret. In a single chucking, all indicated drilling, reaming, and spotfacing operations are completed. A single operator loads rough blanks, trips the machine, and the cycle begins. While the cutting units are working, the operator removes a finished part and reloads the work holder at his station. *The cycle is completed in 14.2 seconds.*

Such multiple machining performance can be duplicated on many parts, yet, because *Kingsbury Fleximatics* are assembled from standard units, you have a special purpose machine at much lower cost. It will pay you to investigate the high production capacity and unusual flexibility of Kingsbury Fleximatics. Let our engineers study your production problems; it does not obligate you.

WE PUT OUR HEADS TOGETHER TO CUT YOUR DRILLING COSTS

KINGSBURY

KINGSBURY

MACHINE TOOL CORP.

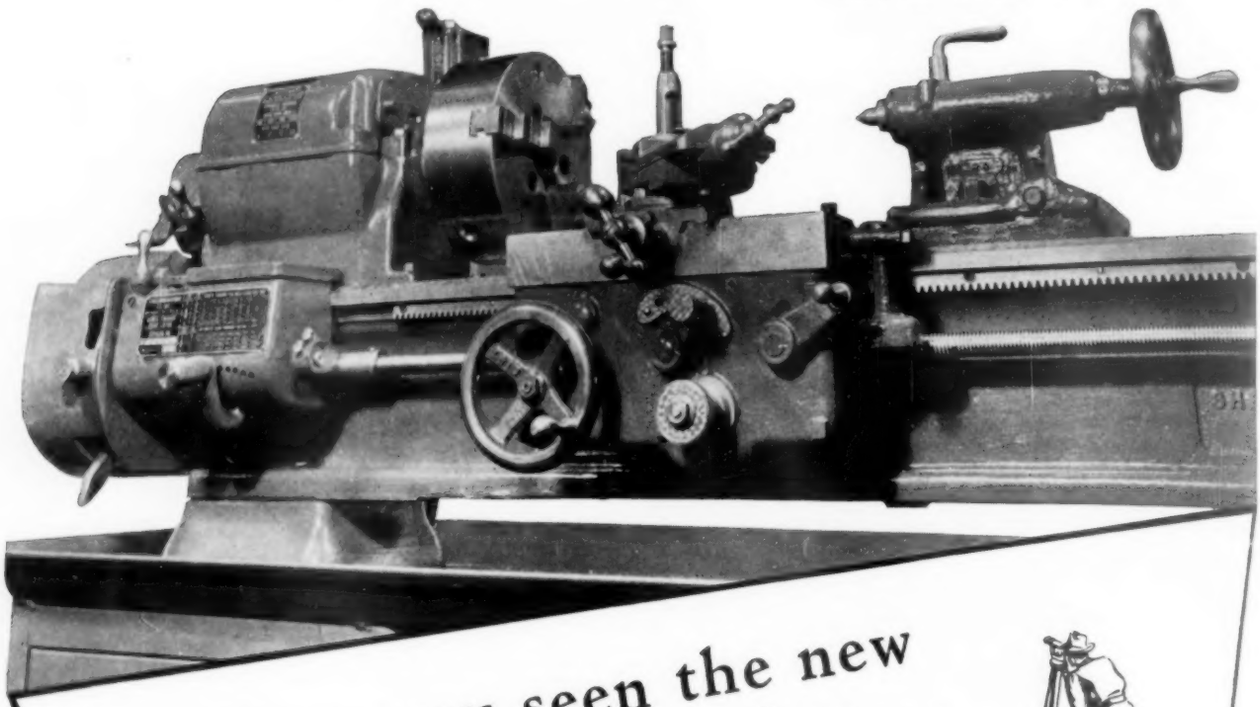
KEENE, NEW HAMPSHIRE

Write for Bulletin G

*** KINGSBURY FLEXIMATIC**

—a special purpose machine for combined automatic operations during a single chucking —the result of Kingsbury engineering ability in the use of low cost *standard* Kingsbury drilling and tapping-heads on *standard* Kingsbury bases.

SHELDON Precision Lathes



Have you seen the new SHELDON Lathes . . .

From any angle a better lathe.

. . . those built in the new SHELDON machine tool plant? Always good lathes, these new SHELDONS are even better, not only in design refinements but in extreme accuracy, greater work capacity for size, "sweeter" handling and actual beauty of finish. Only a set-up like the new SHELDON plant could build such lathes—a specially designed building, the most modern manufacturing methods, complete tooling with row on row of the finest, most modern manufacturing equipment.

Make it a point to stop in at your SHELDON dealer's and see these new machine tools. Note their moderate prices. They are a revelation of what modern equipment and methods produce.

Write for Catalog

SHELDON MACHINE CO. Inc.

Manufacturers of Sheldon Precision Lathes • Arbor Presses • Vises
Sheldon-Vernon Horizontal Milling Machines • Vertical Milling Machines and Jig Borers • Shapers
4229 N. KNOX AVENUE • CHICAGO 41, ILLINOIS, U. S. A.

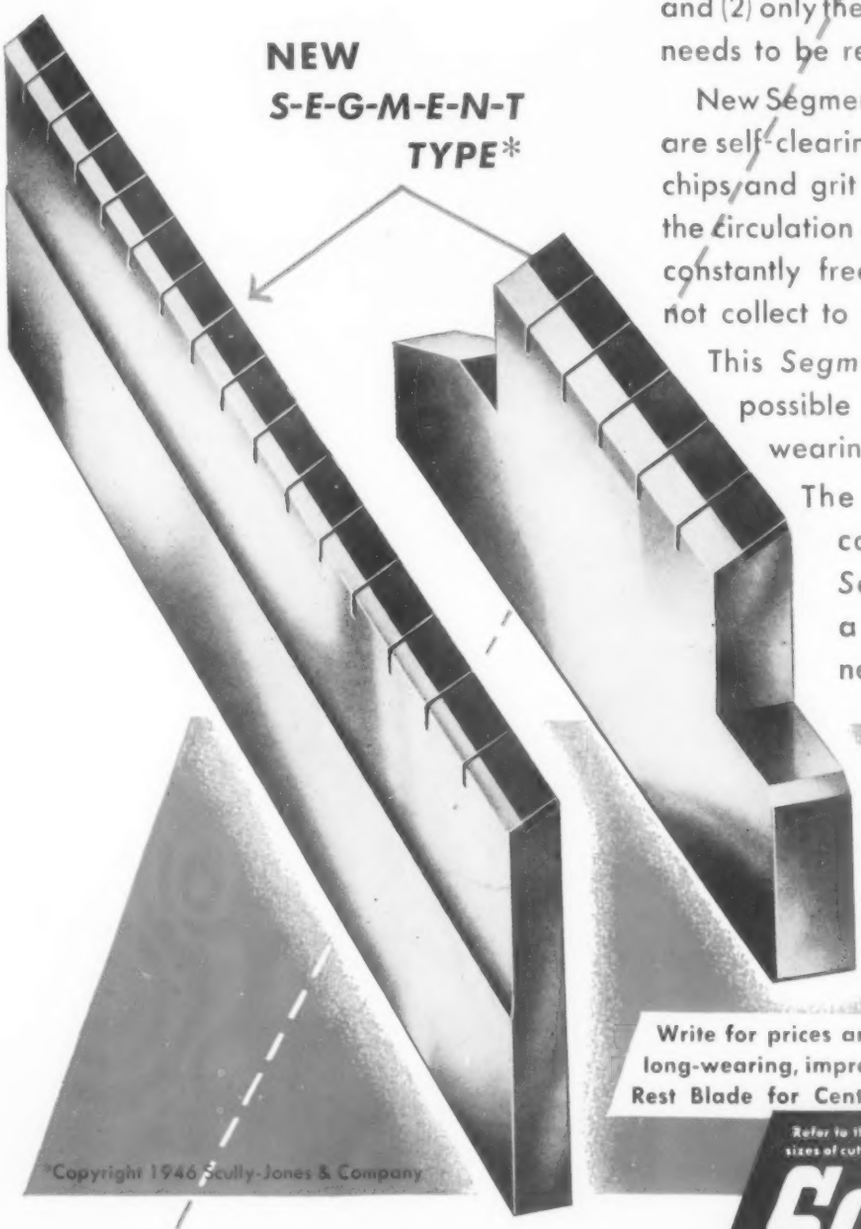
CUT THE COST OF TUNGSTEN CARBIDE-TIPPED WORK REST BLADES

NEW SCULLY-JONES *Segment-Type** WORK REST BLADES will save you money because (1) a *damaged blade is no longer a lost blade,* and (2) only the individual *damaged segment* needs to be replaced.

New Segment SLOTS (an exclusive feature) are self-clearing and so designed that metal chips and grit are quickly carried away by the circulation of the coolant. Thus, with slots constantly free of accumulation, chips do not collect to mar the work being ground.

This *Segment-Type** Design makes it possible to use a harder, longer-wearing grade of carbide.

The cost of Scully-Jones re-conditioning service on this *Segment-Type** Blade is but a fraction of the cost of a new blade.



*Copyright 1946 Scully-Jones & Company

Write for prices and delivery on this long-wearing, improved type of Work Rest Blade for Centerless Grinders.

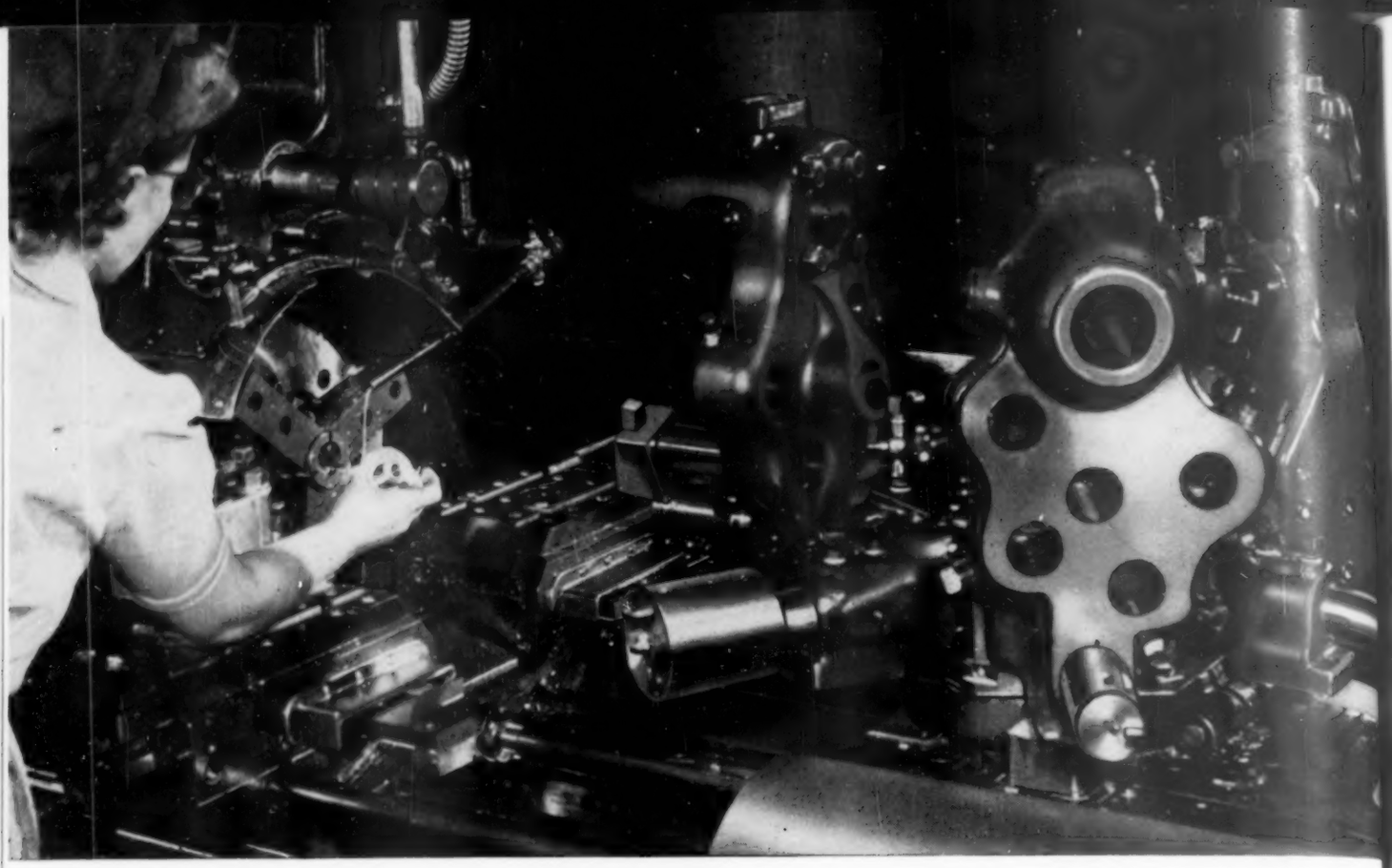
SCULLY-JONES *SEGMENT-TYPE** T.C.T. WORK REST BLADES

Refer to the Scully-Jones Catalog showing over 500 types and sizes of cutting tools, collet chucks, boring equipment, centers, etc.

Scully-Jones AND COMPANY

1913 SOUTH ROCKWELL STREET · CHICAGO 8, U. S. A.

1796



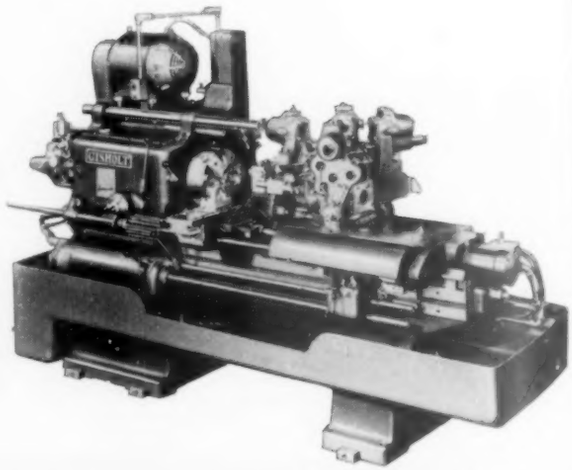
Production *Multiplied by Four* with the *FASTERMATIC*

• Where you have a part like this, requiring as many as six operations in one chucking, you have an ideal job for the Fastermatic.

Here, for example, the machining of gear blanks calls for a series of rough and finish turning, facing, and boring operations which formerly required eight minutes per part. With the Fastermatic, all these cuts are handled with the advantage of a completely automatic machining cycle. Time was reduced to only two minutes per part—a saving of 75%. And costs were reduced by 14 cents per piece.

The ability to handle a large number of operations in one chucking and require but little of the operator beyond loading and unloading the work, makes the Fastermatic a most profitable investment in low-cost production. Write for literature.

On these gear blanks, six operations are completed in 105 seconds, actual cutting time. Floor-to-floor time is 125 seconds.



The Fastermatic is a universal automatic turret lathe for both high and low production machining. It is equipped with a hydraulic feed system, automatically controlled by standard feed cams.

GISHOLT MACHINE COMPANY

1257 East Washington Ave. • Madison 3, Wisconsin

Look Ahead . . . Keep Ahead . . . with Gisholt

TURRET LATHES • AUTOMATIC LATHES • SUPERFINISHERS • BALANCERS • SPECIAL MACHINES

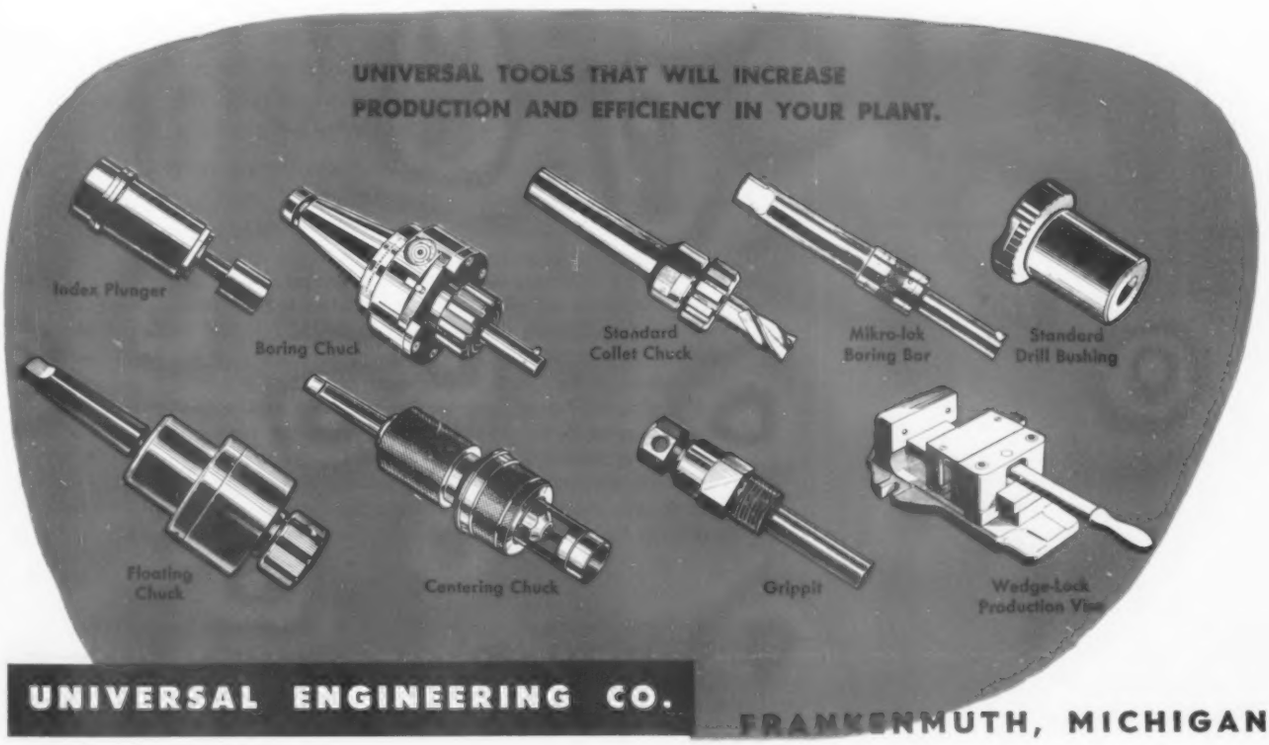
UNIVERSAL FLOATING COLLET CHUCKS

FOR VERTICAL OPERATION

FOR HORIZONTAL OPERATION

With the new Universal Floating Collet Chuck you can perform more accurate reaming, counterboring and tapping operations at great savings in time and effort. A new-type seal permanently prevents entrance of coolant into the chuck mechanism, so that cutting compound can be used to permit heavy feeds at high speeds. In the horizontal chuck, frictionless ball bearing flat springs can be quickly adjusted to counterbalance tool weight, bringing tool to center of work in minimum time. Neither the seal nor springs restrict the floating action — positively the most sensitive on the market today. An interlocking assembly of radially ground bearings carries both driving and thrust loads, eliminating auxiliary bearings which increase friction and resistance. Reams straight-round holes with an exceptionally fine finish (30 micro inches).

Write for complete particulars on Universal Floating Collet Chucks and other superior Universal tools that will increase accurate production in your shop



UNIVERSAL ENGINEERING CO. FRANKENMUTH, MICHIGAN

DESIGN

A complete engineering service, backed by an experienced staff, is at your service to make recommendations and design special cutters.

RANGE

Hundreds of sizes, dozens of models to meet every requirement, regardless of machines used or materials to be cut.

SERVICE

Even special tools use standard parts which are stocked by us. There are 20 Lovejoy service centers throughout the U.S.A. — there is one near you.

30 YEARS' SATISFACTION

Nearly 30 years' continuous experience making milling cutters and other "Positive-Locking" tools. Our first customers are still buying our tools.

...from tiny acorns grow

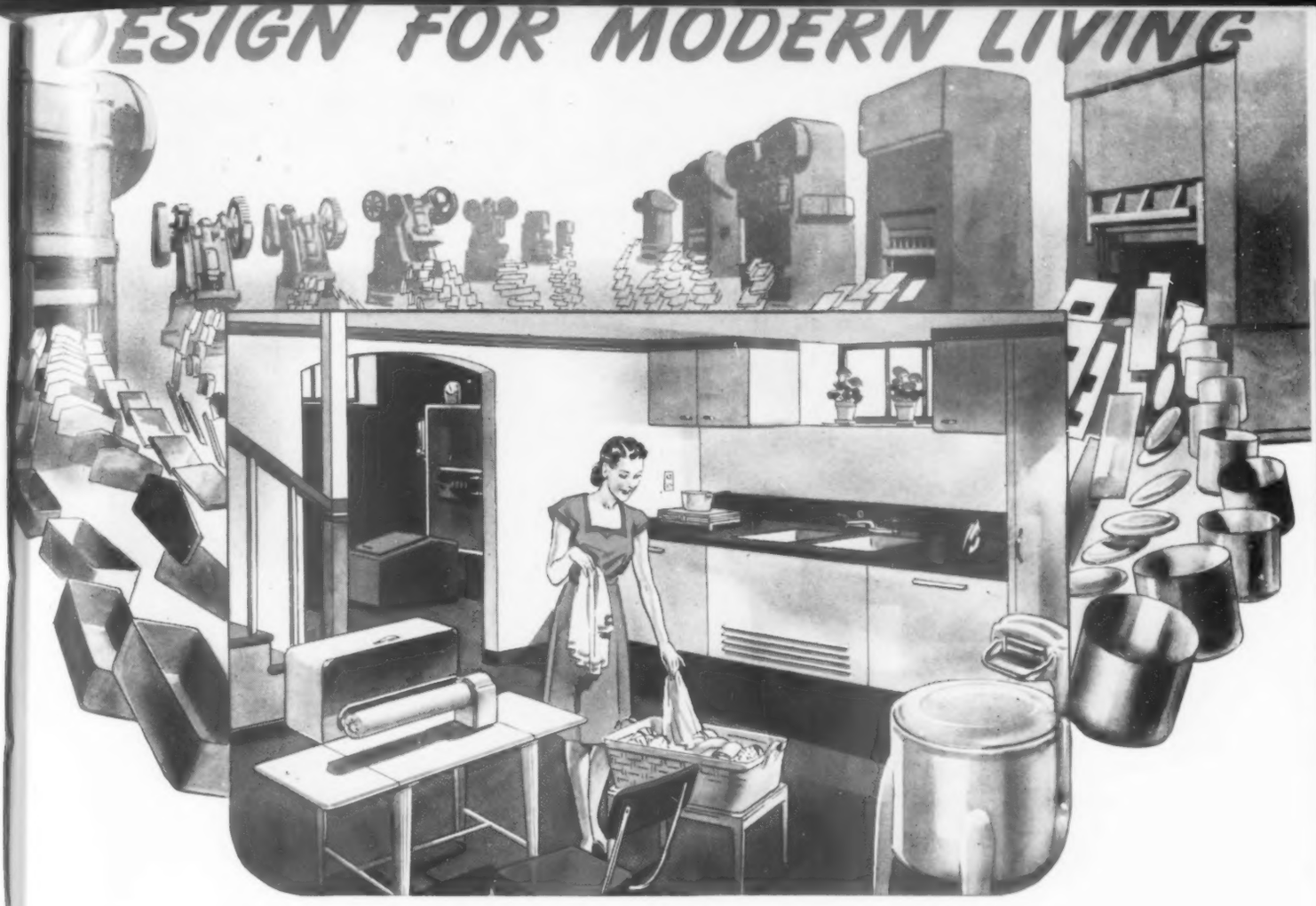
Lovejoy's business is based on a sound idea. Small in size? Yes. Big in importance? Yes. This sound idea is the "Positive-Locking" device used to secure the cutting blades in Lovejoy Milling Cutters. It consists of just two parts — the serrated shoe and the locking wedge. Tools needed for blade adjustment consist of a pin and hammer.

It is simplicity itself, yet blades are held immovably, even under the strains imposed by negative rake carbide cutting practice — even when these cuts are intermittent.

Lovejoy makes superior milling cutters—has experienced engineers to help on any standard and special applications—has a range of models and sizes for every job—has nationwide service for your convenience.

LOVEJOY TOOL COMPANY, INC.
SPRINGFIELD, VERMONT, U. S. A.

DESIGN FOR MODERN LIVING



in Press Production Today

Designed for press production, the stamped products reaching the American Home—the new washing machine, electric ironer, stoker and metal cabinets—create a new design for living. The once messy basement becomes a modern, pleasant workroom.

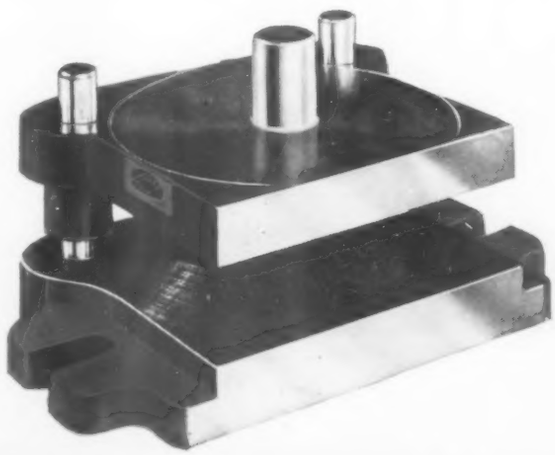
Wherever stamped products are being turned out, Danly Die Sets and Die Makers' Supplies guarantee precision, speed die making programs and cut "down time," because Danly means *known dependable accuracy*.

DANLY MACHINE SPECIALTIES, INC.
2100 South 52nd Avenue • Chicago 50, Illinois

DANLY *National Assembly*

Call Danly

- **MILWAUKEE 2** — *111 East Wisconsin*
- **DETROIT 16** — *1549 Temple Avenue*
- **CLEVELAND 14** — *1550 East 33rd Street*
- **DAYTON 2** — *990 East Monument*
- **ROCHESTER 4** — *16 Commercial Street*
- **PHILADELPHIA 40** — *3858 Pulaski Avenue*
- **LONG ISLAND CITY 1** — *47-28 37th Street*
- **DUCOMMUN METALS & SUPPLY CO.** — *4890 South Alameda, Los Angeles*

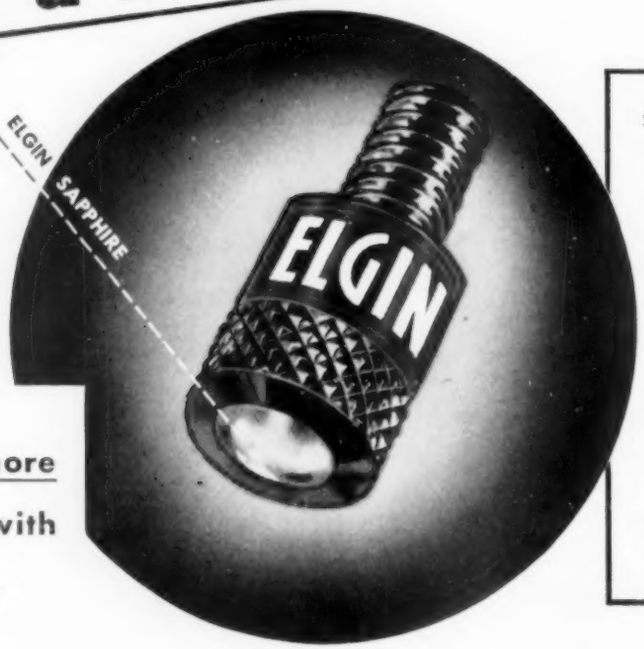


DIE MAKERS' SUPPLIES

DANLY DIE SETS

Welded Steel Fabrication

Here is a Point to Remember



You'll get many more accurate gagings with Elgin Sapphire

Specifications of the dial indicator point shown

- Oil hardened steel body
- Thread 4-48 x .187
- Body .250 O.A.L.
- Body .187 O.D.
- Sapphire point radius .187

$3.50 EACH

Discounts on quantities. Also available through your jobber.

Wear resistance of Elgin Sapphire is truly remarkable—as proved in thousands of industrial installations. Treated by exclusive process, Elgin Sapphire possesses a combination of hardness and toughness exceeding all known man-made materials. It is dimensionally stable—unaffected by acids—non-porous—monocrystalline. Does not scratch or mar work.

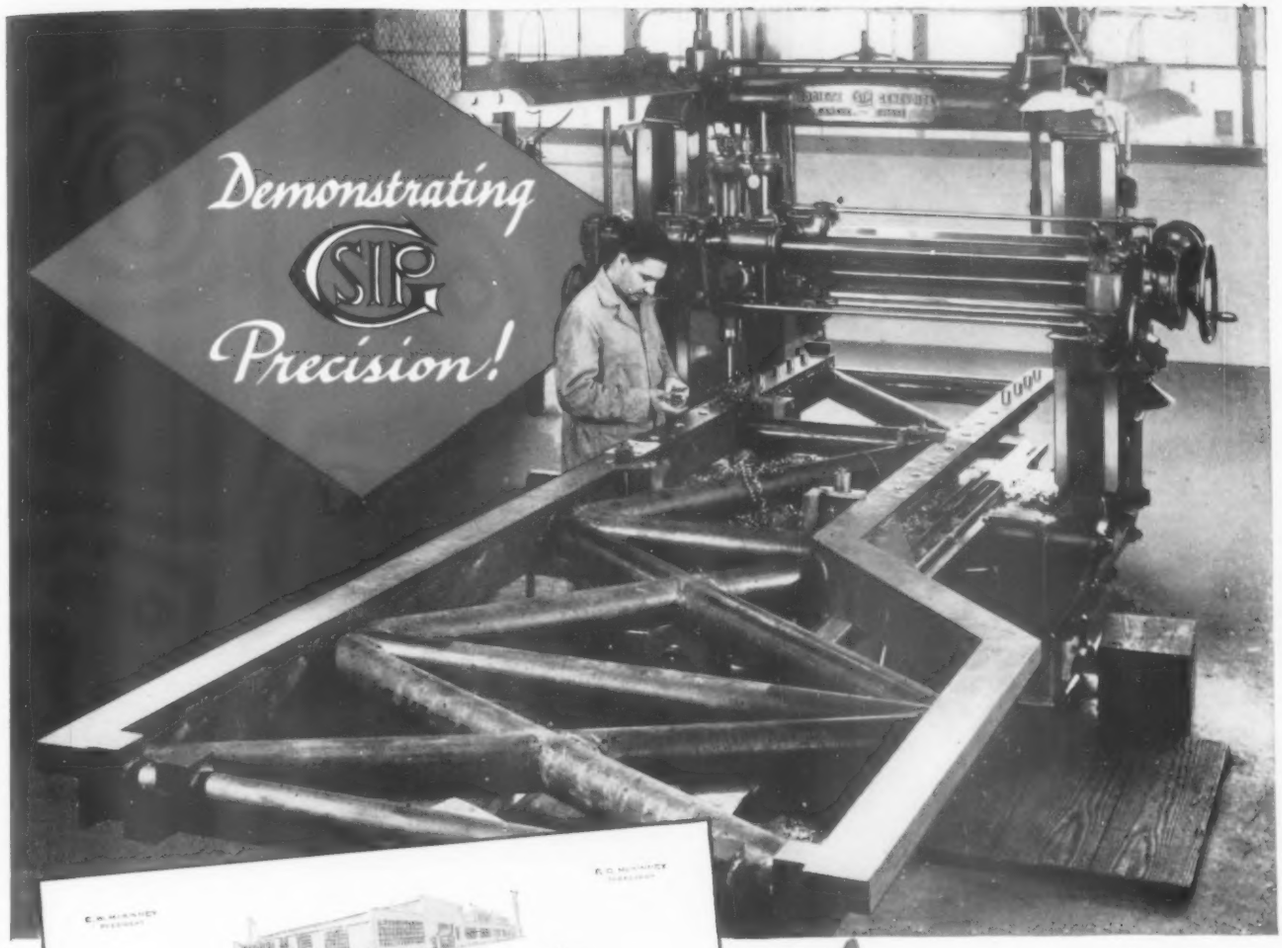
Nationwide reordering of Elgin Sapphire is equipping the most modern manufacturers with devices to improve product and save money. Contact points are another proved successful application—other products are Sapphire Tipt Micrometers, Plug and Ring Gages, Standard Shapes, Certain Burnish-Cutting Tools, Sizing Tools, etc.

SPECIFY ELGIN SAPPHIRE

Other Elgin Sapphire contact points can be furnished to your specifications to fit any dial indicator. Shown here are a few representative shapes we have made.

SAPPHIRE PRODUCTS DIVISION
Elgin National Watch Company, Aurora, Illinois
Representatives in cities from coast to coast

ELGIN
Sapphire Gages
DIMENSIONAL FIDELITY IN GAGING OPERATIONS



THE McKINNEY TOOL & MFG. CO.
1088 ANABELLA ROAD — CLEVELAND 12, OHIO
DESIGNERS AND BUILDERS OF PRECISION TOOLING SINCE 1920 — McKINNEY CLEVELAND — JIGS FIXTURES GAUGES MACHINERY AND CUSTOM MACHINING
Complete Engineering Service

Cosa Corporation
5000 Chrysler Building
New York 17, New York

Gentlemen:

We purchased a SIP Jig Borer in 1936 and have used this machine continuously ever since. During the war years it ran twenty-four hours a day, seven days a week.

Ever since we have had this machine we have had it checked every year and outside of a few minor adjustments, it has never caused us any trouble.

We believe this machine to be by far the best Jig Borer on the market. We do work on this machine that cannot be done on any other Jig Borer. In fact we do quite a lot of custom work for people with other Jig Borers. If we were going to buy another Jig Borer, we would buy no other kind.

Thanking you for your cooperation in the past, we remain

Yours very truly

MCKINNEY TOOL & MFG. CO.

F. C. McKinney

F. C. McKinney

". . . by far the best Jig Borer on the market," says F. C. McKinney, who has put a SIP Jig Boring and Milling Machine to the severest test of continuous operation on jobs like the one shown above.

World famous SIP Jig Borers combine the high precision needed for toolroom work with the speed and dependability of set-up and operation that keep labor costs low—even on direct production.

RANGE OF TABLE SIZES

No. 2C	18" x 10¾"
No. 3K	21½" x 15"
No. 4G	27½" x 23⅝"
Hydroptic B	39½" x 32"
No. 5G	43⅜" x 32"

HIGH PRECISION MACHINE TOOLS AND MEASURING INSTRUMENTS

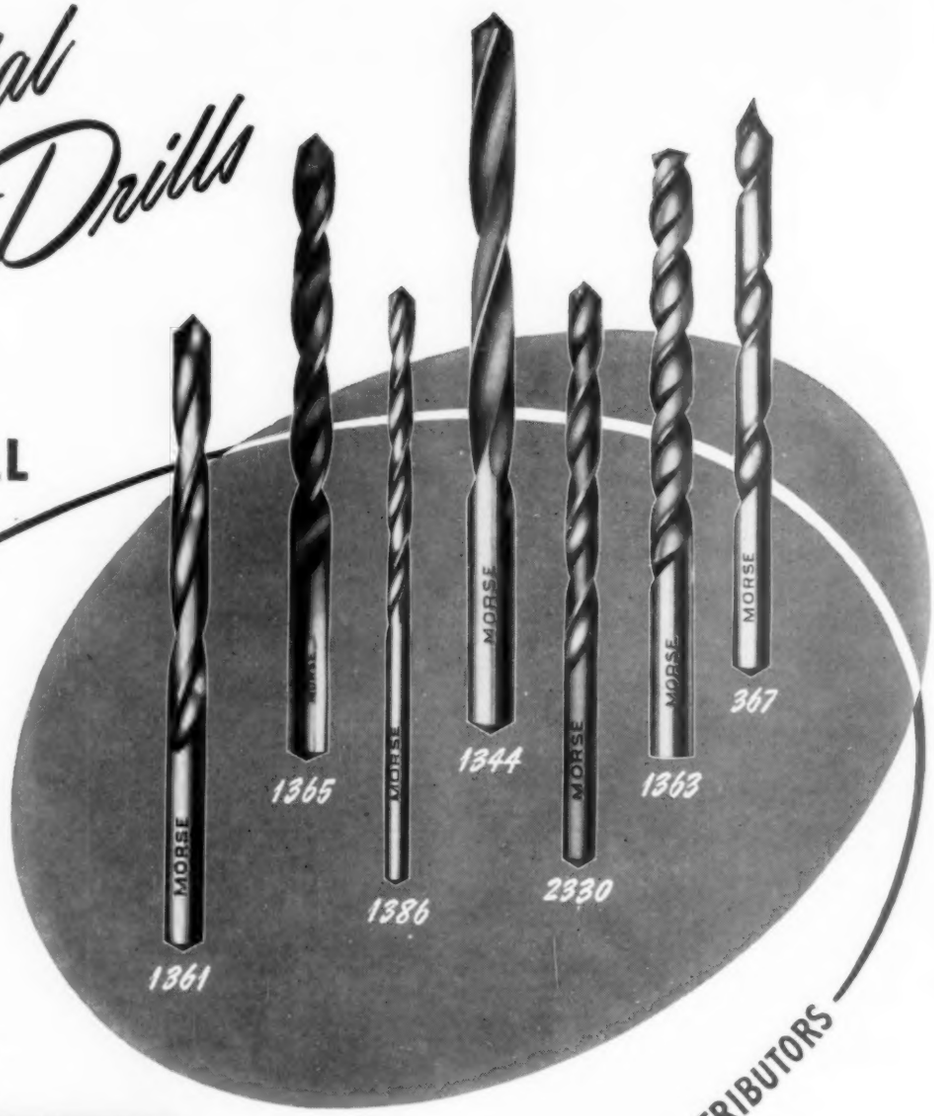
COSA CORPORATION

COSA

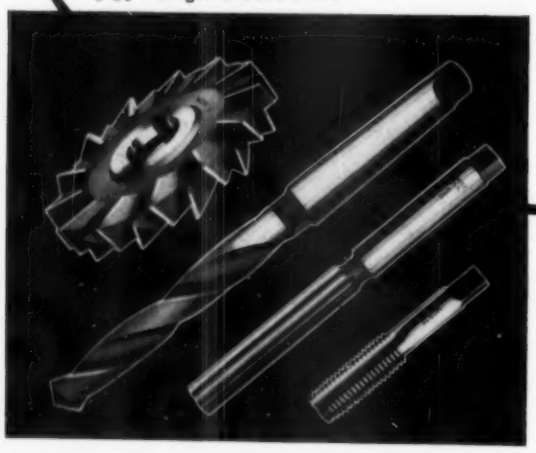
CHRYSLER BUILDING
New York 17, New York

Special Purpose Drills

LARGE AND SMALL



1365 Heavy Duty Drills
1344 Drills For Brass
1361 "Bakelite" Drills
1386 Cotter Pin Drills
2330 Cobalt Drills
1363 "Quick Twist" Drills
367 Single Groove Drills



AS ALWAYS—THROUGH DISTRIBUTORS

To get uniform accuracy in drilling small holes or in all your drilling, tapping and reaming operations – to turn out better work *faster*, every day – always specify Morse Tools.

Styles shown above carried in stock.

MORSE

THERE *IS* A DIFFERENCE

TWIST DRILL AND MACHINE COMPANY
NEW BEDFORD, MASS., U. S. A.

NEW YORK STORE: 130 LAFAYETTE ST. • CHICAGO STORE: 570 WEST RANDOLPH ST. • SAN FRANCISCO STORE: 1180 FOLSOM ST.

This Picture was Produced for YOU!

Arrange now for a showing in your own shop--

OF THE

SIMONDS

COLOR-TALKING PICTURE:

"HACKSAWS AND HOW TO USE THEM"

SEE what actually happens in a hacksaw cut! SEE . . . *and show your men* . . . how to choose and use the proper Hand or Power Hacksaw Blade for any type of cutting. This 16 mm Simonds film shows how to get top performance from the top Hacksaw Blades . . . Simonds "Red End" Blades . . . made in 3 types of special steel from Simonds Steel Mills. For a showing of this film, ask your Industrial Supply Distributor or the nearest Simonds office.

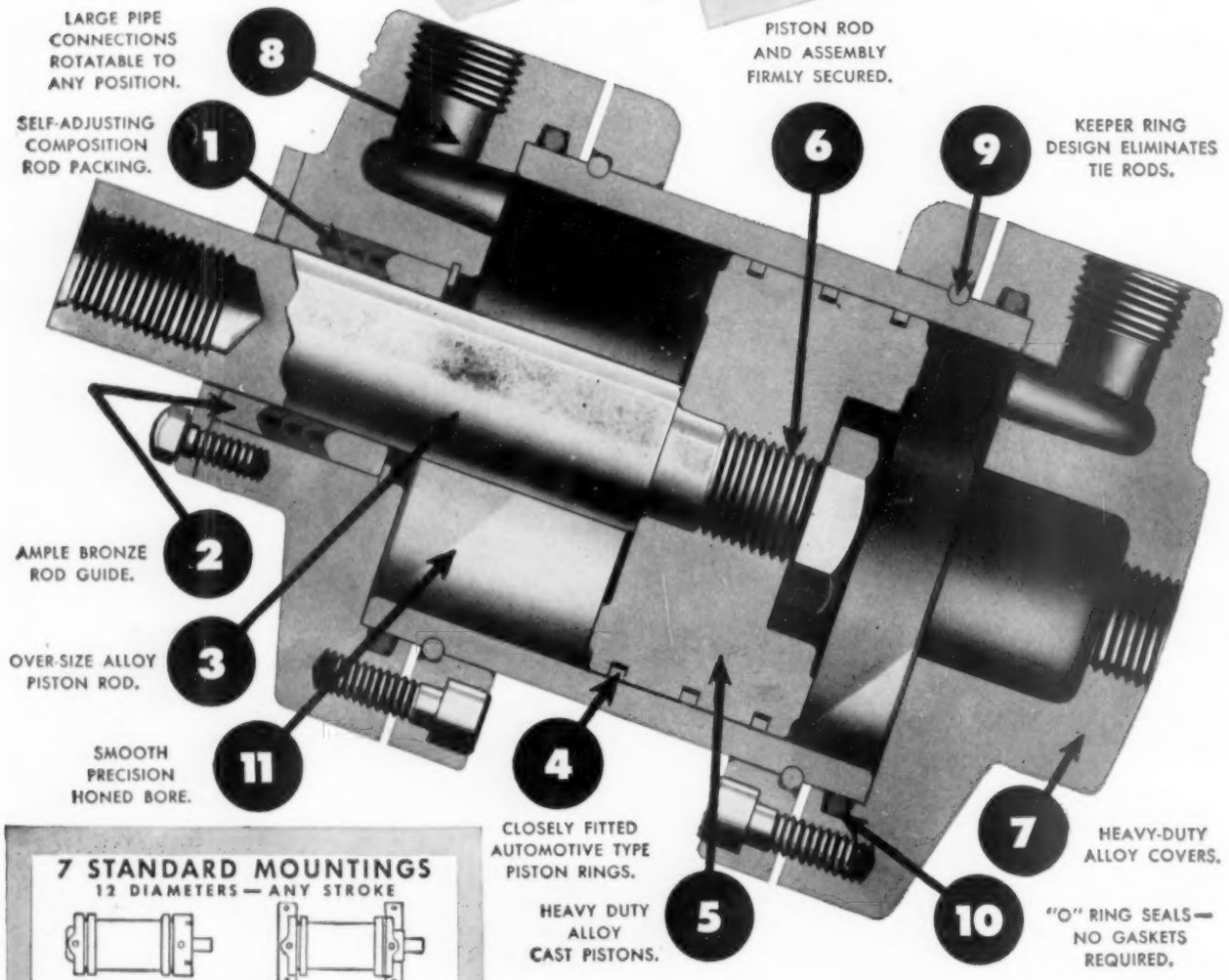
SIMONDS SAW AND STEEL CO.

FITCHBURG, MASS.

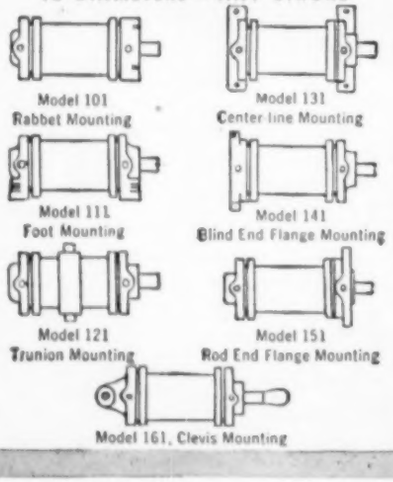
BRANCH OFFICES: 1350 Columbia Road, Boston 27, Mass.; 127 S. Green St., Chicago 7, Ill.; 416 W. Eighth St., Los Angeles 14, Calif.; 228 First St., San Francisco 5, Calif.; 311 S. W. First Avenue, Portland 4, Ore.; 31 W. Trent Ave., Spokane 8, Washington. *Canadian Factory:* 595 St. Remi St., Montreal 30.

11 Reasons WHY

GEROTOR HYDRAULIC CYLINDERS HANDLE YOUR POWER NEEDS EFFICIENTLY



7 STANDARD MOUNTINGS
12 DIAMETERS — ANY STROKE



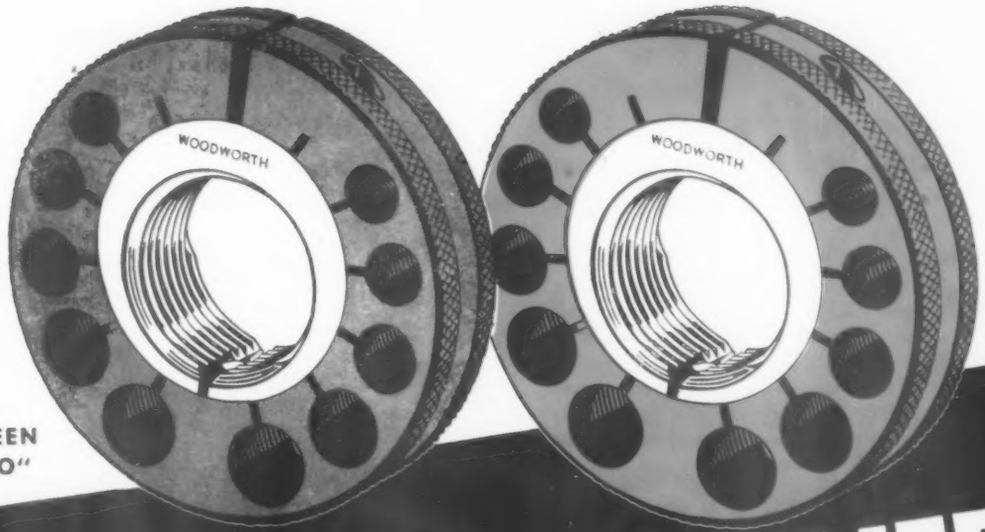
Gerotor hydraulic double-acting non-rotating cylinders are designed for 750 P.S.I., 1500 P.S.I., and 3000 P.S.I. oil or water service.

Keeper ring design eliminating need of tie rods permits covers to be rotated to convenient pipe location. "O" ring seals assure leak proof operation with sealing efficiency improved with increased pressure.

Cushioning feature available on all models. Special cylinders supplied to specifications.

GEROTOR MAY CORP.

MARYLAND AND OLIVE STREETS
BALTIMORE, MARYLAND



RED
"NOT GO"
Pat. Pending

GREEN
"GO"

NOW! GAGE LIFE 12½ TIMES LONGER ...SERVICE RECORDS SHOW

5-PLUS FEATURES

1. Greater accuracy and stability
2. Longer wear life
3. Less weight
4. Positive identification
5. Positive adjustment

ACCURACY YOU CAN TRUST

WOODWORTH THREAD RING GAGE PROVES AMAZING SUPREMACY OVER ORDINARY GAGES

Almost unbelievable results on actual shop inspection prove the new Woodworth Adjustable Thread Ring Gage far superior to ring gages of ordinary design.

ONE MANUFACTURER, USER OF MANY GAGES, MAINTAINED ACCURATE INSPECTION WITH A SINGLE WOODWORTH GAGE TWELVE AND ONE-HALF TIMES LONGER THAN WITH ANY RING GAGE PREVIOUSLY USED. THINK WHAT THIS MEANS TO YOUR GAGE COSTS.

Wire or write for folder No. 46R.

WOODWORTH

N. A. WOODWORTH CO., SALES DIVISION, 1300 E. NINE MILE ROAD • DETROIT 20, MICHIGAN

PRECISION GAGES • PRECISION MACHINE PARTS • DIAPHRAGM CHUCKS • ADJUSTABLE CLAMPING JIGS • SPECIAL TOOLS

Capacity . . .

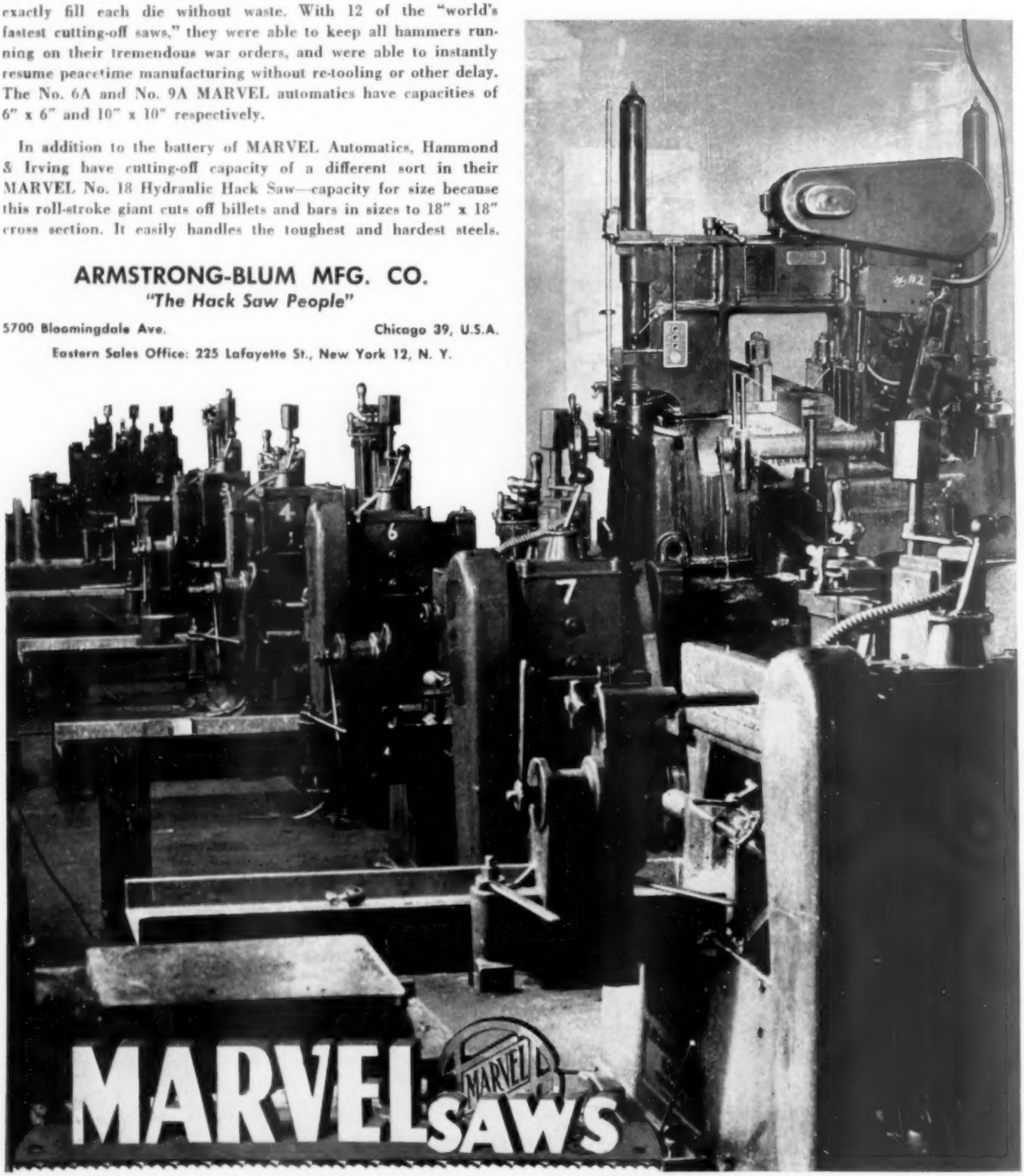
MARVEL 18 *for Size,* MARVEL 6A and 9A *for Volume Production*

With this battery of twelve No. 6A and No. 9A MARVEL High Speed Automatic Hack Saws, the Hammond & Irving Forge Co. of Auburn, New York, can cut off billets automatically, not only in tremendous numbers, but in accurate weights and sizes to exactly fill each die without waste. With 12 of the "world's fastest cutting-off saws," they were able to keep all hammers running on their tremendous war orders, and were able to instantly resume peacetime manufacturing without re-tooling or other delay. The No. 6A and No. 9A MARVEL automatics have capacities of 6" x 6" and 10" x 10" respectively.

In addition to the battery of MARVEL Automatics, Hammond & Irving have cutting-off capacity of a different sort in their MARVEL No. 18 Hydraulic Hack Saw—capacity for size because this roll-stroke giant cuts off billets and bars in sizes to 18" x 18" cross section. It easily handles the toughest and hardest steels.

ARMSTRONG-BLUM MFG. CO.
"The Hack Saw People"

5700 Bloomingdale Ave. Chicago 39, U.S.A.
Eastern Sales Office: 225 Lafayette St., New York 12, N. Y.



Bryant Thread Gages

. . . An Entirely NEW PRINCIPLE in the Field of Thread Inspection

ANYONE who can *push* a lever, *drop* a part, and *read* a large dial gage, *can inspect threads* to any desired degree of accuracy on Bryant Thread Gages. That's how easy it is. There's no slow and tiresome threading of plug and ring gages into and onto the work. There's no "feeling" for the class of fit.

Combined with this ease of operation is speed. The Bryant Method is *four* or *five times faster* than plug or ring gaging. Because the method is so simple, this speed is attained by inexperienced operators *on the first day*.

Speed us the coupon for complete details.

Please send me Catalog No. G3 which gives complete details on the Bryant Thread Gages.

Name_____ Title_____

Company_____

Street_____

City_____ State_____

NEW PORTABLE THREAD GAGES
and Squareness of Face Gages, Universal Hole Size Gages, Both Internal and External.

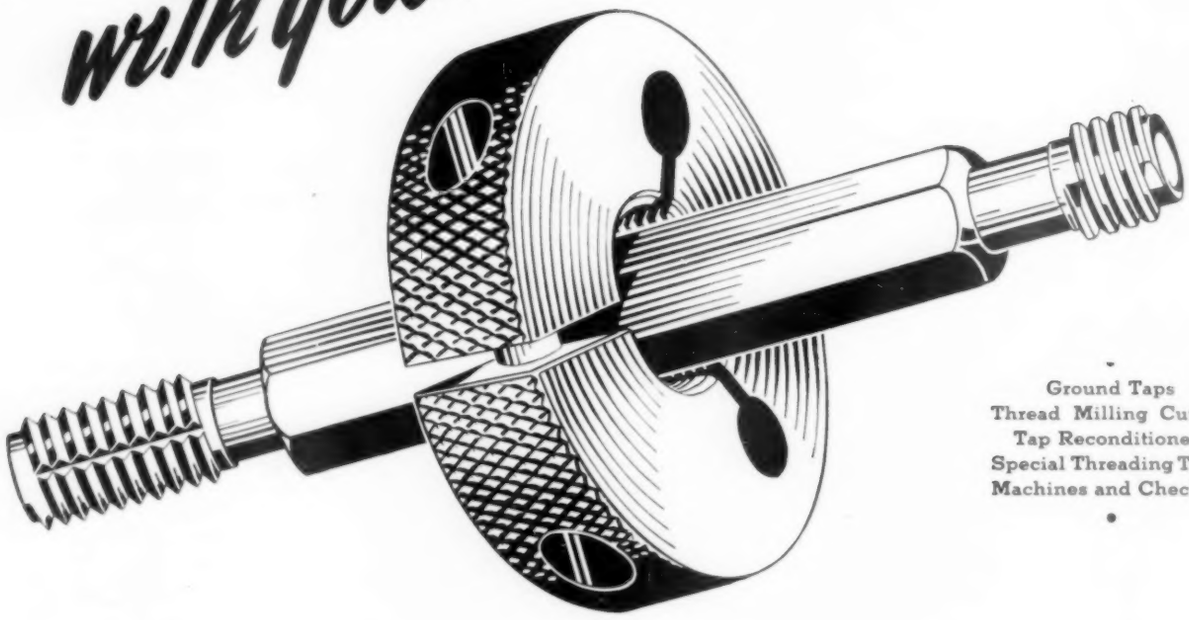
BRYANT

BRYANT CHUCKING GRINDER CO

SPRINGFIELD, VERMONT, U. S. A.

June, 1946

Don't get caught with your tolerances down



Ground Taps
Thread Milling Cutters
Tap Reconditioners
Special Threading Tools
Machines and Checkers

BIRMINGHAM, Ala.	Birmingham 7-1017
BUFFALO 2, N. Y.	GRant 6601
CHICAGO 12, Ill.	KEdsie 3170
CINCINNATI 2, O.	MAin 2544
CLEVELAND 13, O.	CHerry 3520
DAYTON 2, O.	FUlton 6161
DENVER 2, Colo.	KEystone 7229
DETROIT 11, Mich.	MAdison 0260
FLINT, Mich.	Flint 4-3661
HOUSTON, Tex.	CApitol 5487
INDIANAPOLIS 9, Ind.	FRanklin 2456
LOS ANGELES, Calif.	ADams 1-4381
MILWAUKEE 2, Wisc.	DAily 4256
MINNEAPOLIS, Minn.	MAin 1488
MUSKEGON, Mich.	Muskegon 248
NASHVILLE 6, Tenn.	Nashville 6-3647
NEWARK 2, N. J.	MArket 3-1493
PITTSBURGH 19, Pa.	ATlantic 3011
ROCKFORD, Ill.	MAin 2243
ST. LOUIS 1, Mo.	CEntral 4435
SAN FRANCISCO, Calif.	DOuglas 7711
SOUTH BEND 3, Ind.	South Bend 3-0009
SYRACUSE 9, N. Y.	SYracuse 8-1462
TOLEDO 4, O.	GArfield 8302
MONTREAL, Canada	MAin 5346
TORONTO, Canada	WAverly 2688
WINDSOR, Canada	Windsor 4-9229

History shows that industry never turns backward. This applies to tolerances, also. During World War II, thousandths and half thousandths shrank to one or two-tenths. Peace-time industry, in all likelihood, will continue to work to these—and even closer—tolerances.

You can obtain *from our stock*, for immediate delivery thread plug and ring gages, which will assure you that your threads are being held to today's close tolerances.

The Detroit Tap Representative in your area will be glad to advise you of the number of each size of gage in stock at any given time. Give him a call today.

DETROIT
TAP & TOOL CO.
8432 BUTLER AVENUE DETROIT 11, U. S. A.

The same quality tap head which Haskins features in its high-speed Electric-Air controlled tapping machine. It easily fits your own drill press to provide more economical production, greater tapping accuracy, longer trouble-free operation. Send for catalog D.

- PRECISION CONSTRUCTION
- BALL BEARINGS THROUGHOUT
- DOUBLE CONE FRICTION CLUTCH
- DOUBLE SPEED REVERSE
- COUNTERBALANCED SPINDLE
- ALUMINUM HOUSING
- INDIVIDUAL GROUND COLLETS
- NON-GLARE CRYSTAL FINISH
- IMMEDIATE DELIVERY
- STURDY, VIBRATION-FREE
- LUG TYPE SPINDLE AVAILABLE FOR EXTERNAL THREADING WITH ACORN DIES

R. G. HASKINS CO. • 2741 W. Flournoy St. • Chicago 12

HASKINS haskins PRECISION TAPPING EQUIPMENT

SIMPLEX

There are many simple precision boring operations best handled by a simple machine which is applicable to a variety of work and can be operated by relatively unskilled labor. This type of machine permits adjustments and maintenance by the operator thus conserving the limited supply of skilled help for those places where it is really essential. Precision is built into the machine; design of the fixture makes loading and unloading easy for the operator; investment is low justifying its use on small production quantities.

The SIMPLEX No. 2B Precision Boring Machine shown is equipped with No. 3 spindle and a multiple step locator type of fixture for mounting three sizes of motor end shields for precision boring bearing holes in accurate concentricity with the rabbet. A quick-acting clamp operates two hook bars which both seat and eject the piece mechanically so that loading and clamping is very fast and positive and ejection equally fast and positive. Micrometer eccentric adjustment of the tool makes for extreme accuracy in addition to concentricity and squareness desired.

Precision Boring Machines

STOKERUNIT CORPORATION

SIMPLEX Machine Tools Division

4528 West Mitchell Street, Milwaukee 14, Wisconsin

Precision Boring Machines, Planer Type Milling Machines and Special Machine Tools

Get ALL the advantages of magnetic holding

Use Brown & Sharpe Permanent Magnet Chucks

COST NOTHING TO OPERATE . . . EVEN TO INSTALL

★ No electricity, wires, electrical connections, generators or brushes.

★ Nothing to maintain. Special alloy magnets retain energy indefinitely.

SAFE FOR WORKMAN AND WORK

★ No danger of work flying off due to power interruption.

★ Work can be left on chuck indefinitely without danger of heating either chuck or work.

SIMPLE MECHANICAL CONTROLS

★ Hand-operated. Easy 180° movement from ON to OFF position.

★ POSITIVE HOLDING

★ INSTANT RELEASE

★ plus wide variations of holding force for easy positioning of work.

MORE USEFUL IN MORE PLACES

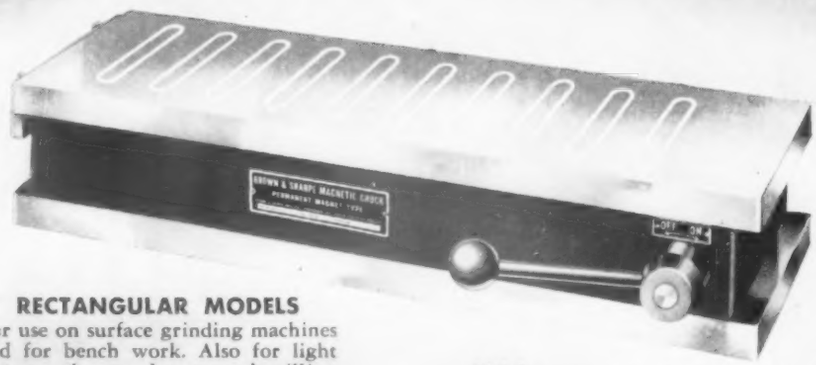
★ Portable . . . for use on various machines, also for testing, inspection and laying out work.

★ Wet or dry grinding.

★ Large, heavy work or groups of small parts.

★These chucks are for sale only in the United States of America and its Territories.

ROTARY MODEL
for grinding operations and light cuts on lathes.



RECTANGULAR MODELS
For use on surface grinding machines and for bench work. Also for light cuts on planers, shapers and milling machines.

ALSO permanent magnet V blocks and dial test indicators with magnetic bases.

WRITE FOR CATALOG describing operating principles.

BROWN & SHARPE MFG. CO., Providence 1, R. I.

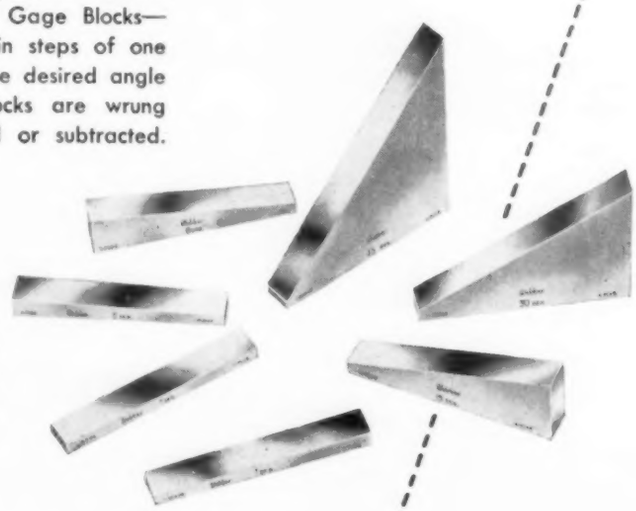
BROWN & SHARPE

PRECISION . . .

at a Price to Suit Your Shop

Webber Micro-Accurate Gage Blocks are furnished individually or in sets to meet the need and budget of your shop. These long-wearing, finely-finished gage blocks bring precision in millionths within the reach of every shop.

370,800 angles are possible with the new Webber Angle Gage Blocks—0 to 103 degrees in steps of one second of an arc. The desired angle is formed when blocks are wrung together and added or subtracted.



Webber Heavy Duty Gage Blocks are of generous proportions for greater wear resistance. These, plus Webber Eccentric Clamps and our new Quick Action Clamp assemble into an inside or outside caliper, precision heighth gage, temporary snap gage or precision divider.

Webber

GAGE COMPANY

12908 Triskett Road • Cleveland 11, Ohio

Find out why
In shop after shop
CIRCLE "C" SUPER HIGH SPEED STEEL
licks the tough jobs!

Circle "C" is the out-and-out choice of many for maintaining peak production and limiting "down-time." Write today for full information, or ask for a convincing demonstration in your own shop.

Call **Firth-Sterling**

STEEL COMPANY

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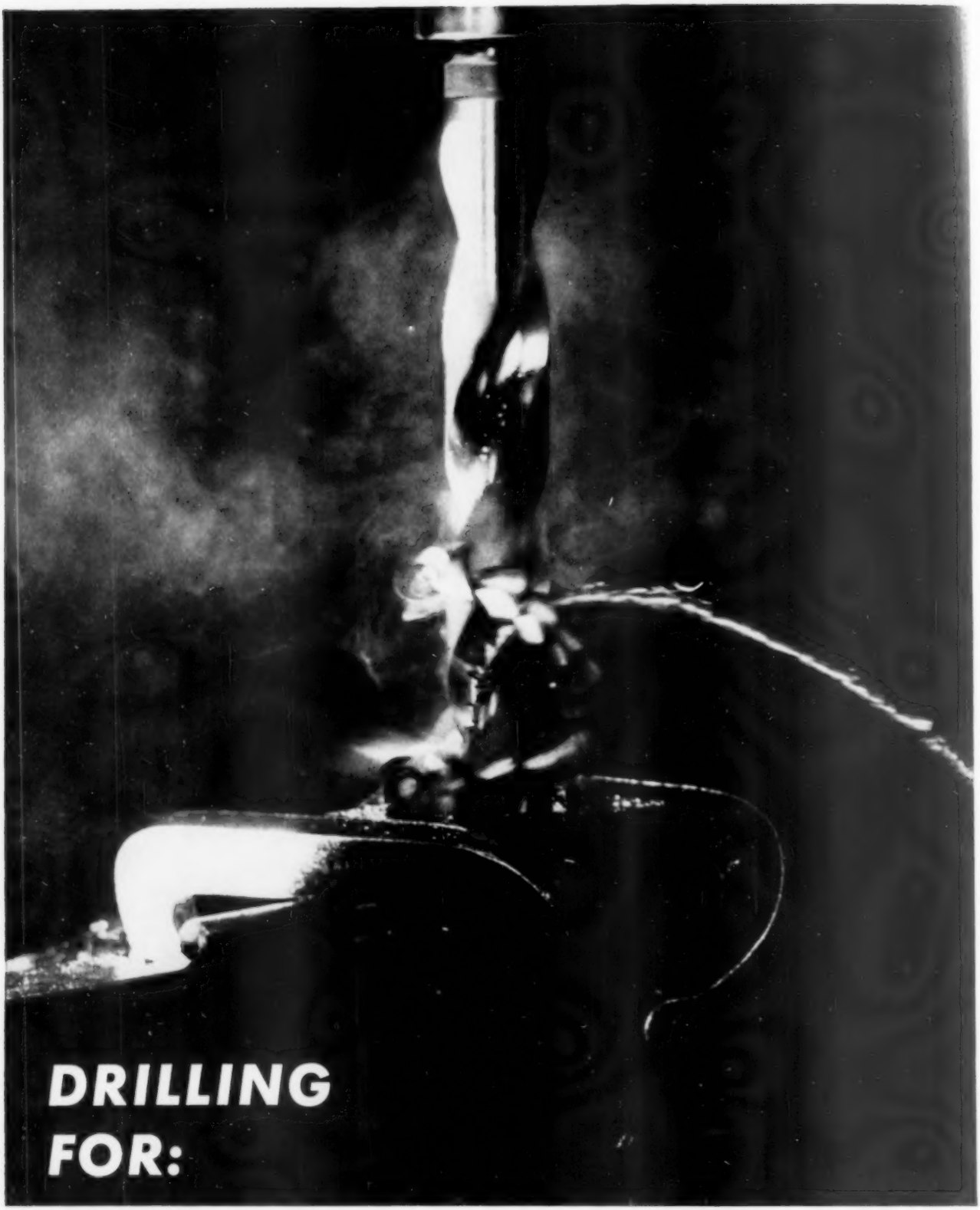
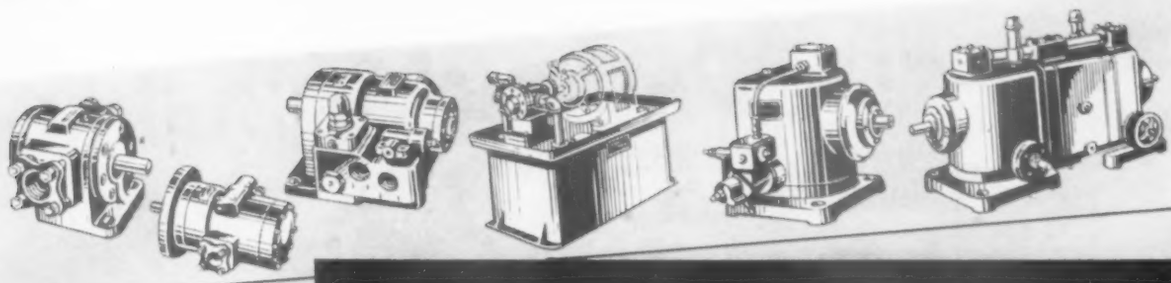


Production Time Accuracy Quality Prestige
Improvement Goodwill Confidence Cooperation Safety

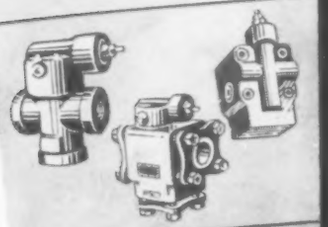
OLOFSSON TOOL AND DIE CO., LANSING, MICHIGAN

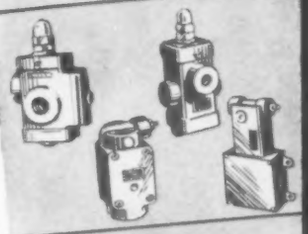
CHICAGO ENGINEERING OFFICE – BUILDER'S BUILDING – 228 NORTH LA SALLE

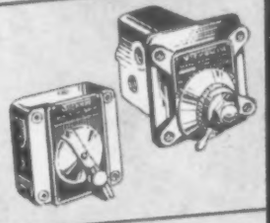


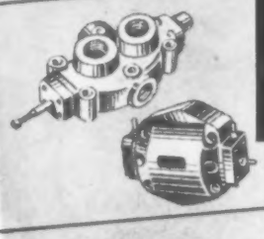
VICKERS

THE MOST COMPLETE LINE of HYDRAULIC PUMPS and CONTROLS

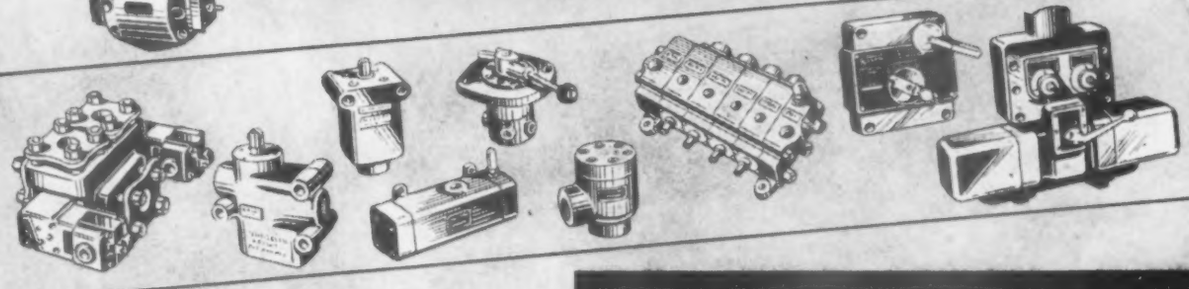


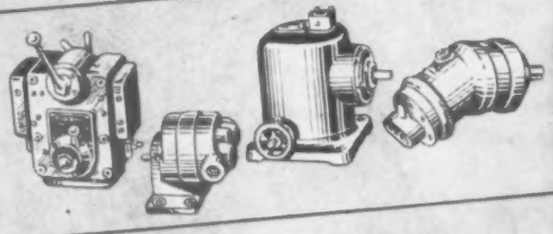






Constant delivery vane type pumps, variable delivery piston type pumps, power units, pressure controls, volume controls, directional controls, cycle control panels, fluid motors, variable speed transmissions . . . these are indicative of the great variety of Vickers hydraulic units. Having the most extensive line of hydraulic equipment, Vickers can meet all hydraulic requirements and provide the important benefits of undivided responsibility. Vickers Application Engineers will be glad to discuss with you how hydraulics can be used to your advantage.





There are more than 5000 Standardized Vickers Units that can be used in various combinations to exactly supply Every Hydraulic Power and Control Function

ANY FEED RATE • ANY TRAVERSE RATE • ANY RPM

ANY SEQUENCE OF MOTIONS • ANY ACCELERATION OR DECELERATION • ANY THRUST . . . . . .

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Engineers Designers Builders

of

Complete Tooling Programs and Special Machinery

A few of the many "production thru engineering" projects we have completed are shown on this page.

We believe we have the finest designers, engineers, and practical production men in our part of the country.

We place these and our complete manufacturing plant, consisting of a machine shop, paint shop, sheet metal shop, stamping and assembly departments, at your service.

Production thru Engineering

HENRY & HUTCHINSON, INC.

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PRODUCTION ILLUSTRATORS DEVELOPMENT ENGINEERS PRODUCTION ENGINEERS

IN MILK.. IT'S HOMOGENIZED

IN HIGH SPEED STEELS... IT'S **DESEGATIZED**

THE IMPROVEMENT IS *apparent at a glance*

• *These are unretouched photographs, slightly reduced, of 4" round bars of 18-4-1 type Latrobe Electrite No. 1 high speed steel. Discs hardened, polished and etched. The one at left produced by ordinary standard process, the one at right Latrobe's revolutionary DESEGATIZED process.*

LATROBE

DESEGATIZED HIGH SPEED STEELS

YOUR COPY IS READY

Be sure to write for this booklet, describing Latrobe's new and exclusive tool steel development!

In Latrobe's DESEGATIZED High Speed Steel, the carbides are evenly distributed throughout the entire cross-section; more evenly than has ever before been possible. This revolutionary improvement is apparent in the photo shown at right. • DESEGATIZED High Speed Steel will do a better job because it is more uniform throughout. It responds more consistently to heat treatment and affords more even resistance to wear. Latrobe's exclusive new process serves to simplify your high speed steel problems.

Our nearest representative will be glad to discuss its application to your particular requirements.

Latrobe **ELECTRIC STEEL COMPANY**

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3

ABRASIVE CUTTING
Reduces 9 Operations to 6

CAMPBELL MAKES A FULL LINE OF ABRASIVE CUTTERS

Campbell Abrasive Cutting Machines are production machines — as this example illustrates. This is one of many instances where a Campbell machine is supplanting other conventional machining methods — simplifying production. Write for more specific information.

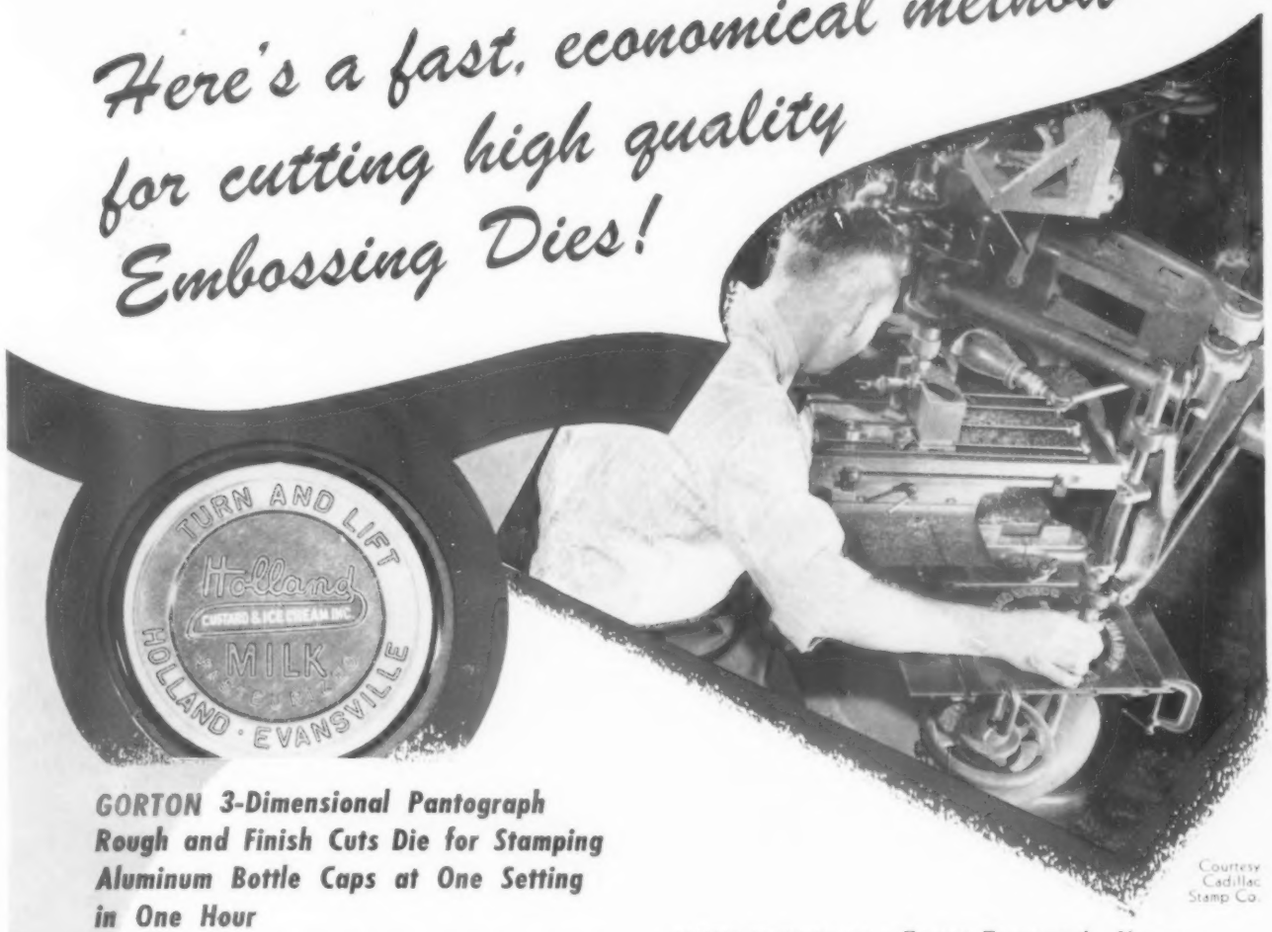
ACCO

TRADE MARK

ALSO MAKERS OF A COMPLETE LINE OF NIBBLING MACHINES

ANDREW C. CAMPBELL DIVISION
AMERICAN CHAIN & CABLE • BRIDGEPORT, CONN.

Here's a fast, economical method for cutting high quality Embossing Dies!



Courtesy Cadillac Stamp Co.

GORTON 3-Dimensional Pantograph Rough and Finish Cuts Die for Stamping Aluminum Bottle Caps at One Setting in One Hour

This large eastern manufacturer recently received an order for a die for embossing aluminum milk bottle caps. Nothing like it had been cut prior to the order so no set procedure had been established.

The job was tooled up on several machines in an effort to find out which would produce the most satisfactory results in the least amount of time. The outcome was definite and decisive. Of the machines used, the Gorton 3L Pantograph gave the best performance. Not only did it turn out the best die but turned it out in the record time of one hour.

Adaptable to Light Production Milling and Engraving Operations

Gorton Pantographs have no equal in the performance of intricate milling and engraving operations. They can be used for the profiling of grooves, contours and other shapes; for the cutting of dies and molds; for engraving numerals and designs in any machinable material; and for numerous other purposes. A special roll attachment makes it possible to work from a flat master or model around rolls, dies, dials, knurls up to 6″ in diameter. Gorton Pantographs are available in two and three dimensional models to handle many sizes and types of work.

Consult Gorton Engineering Service

Perhaps some of the work at which you are now engaged could be accomplished better, faster and with greater economy on a Gorton Pantograph. If you will submit detailed prints of your job to Gorton Engineering Service, our engineers will thoroughly investigate the possibilities and send you a complete report of the results. This service is offered free and without obligation.

JOB FACTS!

NAME OF PART—Milk Bottle Cap Embossing Die—Used in the manufacture of aluminum milk bottle caps.

MATERIAL—Tool steel—hardened and chrome plated after.

MACHINE—Gorton 3-Dimensional Pantograph, Model 3-L.

OPERATIONS—

1. Rough within .001″; depth .008″; speed 2300 r.p.m.
2. Finish in one cut, depth .001″; speed 2300 r.p.m.

TIME—One hour.

FREE . . . Complete Information

For complete information on the Gorton Pantograph, write today for Bulletin No. 1655.

GEORGE GORTON MACHINE CO.

2606 RACINE STREET, RACINE, WISCONSIN, U.S.A.

FOR HIGH PRODUCTION

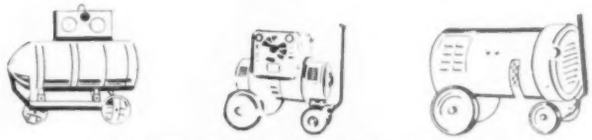
SURPLUS RESISTANCE WELDERS

Now is the time to pick up modern high-production equipment at low cost. Available now, for early delivery are quantities of surplus spot, seam and butt flash welding machines—many unused or used for only short periods. True, much of the equipment was designed for special applications—but nearly all of it is readily adaptable to peacetime product needs—and such needs are being considered in pricing. Chances are that you can find just the equipment you need to modernize your operations or complete your new production plans. So contact your nearest War Assets Administration Regional Office today—write, wire or phone, or use the coupon below.

ALL ITEMS ARE SUBJECT TO PRIOR SALE!

AND FLASH WELDERS

Located in Philadelphia, Detroit, Chicago, Los Angeles, Cleveland, Kansas City, Birmingham, and Boston for quick sale.



LINCOLN, HOBART, AND WESTINGHOUSE ARC WELDERS
DC and AC Types; 300 to 400 amperes
DC available in large quantities.

WELD POSITIONERS
Many sizes and capacities including head and tailstock combinations.

FLAME CUTTERS
Both portable and stationary, single and multiple torch types.

VETERANS OF WORLD WAR II: To help you in purchasing surplus property, veterans' units have been established in each War Assets Administration Regional Office.

FREE FACTS TO WAR ASSETS ADMINISTRATION

Please send me information on the availability, location and condition of the following types of equipment:

- ☐ SPOT WELDERS
- ☐ SEAM WELDERS
- ☐ FLASH WELDERS
- ☐ HOBART ARC WELDERS
- ☐ WESTINGHOUSE ARC WELDERS
- ☐ WELD POSITIONERS
- ☐ LINCOLN ARC WELDERS
- ☐ ..... ARC WELDERS
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Firm.....

Address.....

City..... *State*.....

176-3

WAR ASSETS ADMINISTRATION

OFFICES LISTED BELOW ARE TEMPORARILY IN RECONSTRUCTION FINANCE CORPORATION AGENCIES

Offices located at: Atlanta · Birmingham · Boston · Charlotte · Chicago · Cleveland · Dallas · Denver Detroit · Helena · Houston · Jacksonville · Kansas City, Mo. · Little Rock · Los Angeles · Louisville Minneapolis · Nashville · New Orleans · New York · Oklahoma City · Omaha · Philadelphia Portland, Ore. · Richmond · St. Louis · Salt Lake City · San Antonio · San Francisco · Seattle · Spokane Cincinnati · Fort Worth (Telephone 3-5381)

GOVERNMENT OWNED SURPLUS HEAT TREATING EQUIPMENT

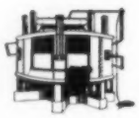
GET IT NOW!

This surplus property is offered to prior claimants, including veterans of World War II.

There is no need to hold up post war production plans because you can't get heat treating equipment. Surplus equipment of modern, high production, design—is available in quantity in every major metal manufacturing area. Furthermore it is priced at levels to permit its profitable conversion from war to peacetime production needs. But the really important factor is that you can get it *now* when you need it most.

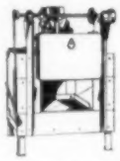
ROTARY HEARTHS

For heat treating in production operations. Semi-automatic operation and control.



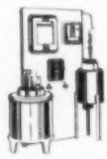
TEMPERING FURNACES

For tempering small work in production or for the tool room or laboratory.



CONTROLLED ATMOSPHERE HARDENERS

For precision tools and dies and applications where surfaces must be protected.



INDUCTION HARDENERS

The latest development in controlled surface hardening by high frequency induction.

VETERANS OF WORLD WAR II: To aid you in purchasing surplus property, a veterans' unit has been established in each War Assets Administration Regional Office.

TAKE THESE 3 STEPS

1 Accurately Determine Your Needs
Check your operations and jot down the type of equipment you need, necessary capacities, ratings, etc. Where possible indicate the make of equipment you would prefer. This information we will need to locate for you suitable surplus equipment.

2 Estimate the Cost You Can Afford
Here again is a guide we need in locating the right equipment for you among many hundreds of available furnaces. In pricing we give consideration to such alterations necessary to meet your specific problems.

3 Fill In and Mail This Coupon

To War Assets Administration: Please send me information on the following types of surplus Heat Treating Equipment:

FUEL	INTENDED USE	TYPE OR MAKE
☐ ELECTRICAL	.....	.....
☐ GAS	.....	.....
☐ OIL	.....	.....
☐ HIGH FREQUENCY INDUCTION	.....	.....

I am also interested in ☐ HEATING FURNACES ☐ MELTING FURNACES ☐ DRYERS ☐ KILNS

Name.....Tel. No.....

Firm.....

Address.....

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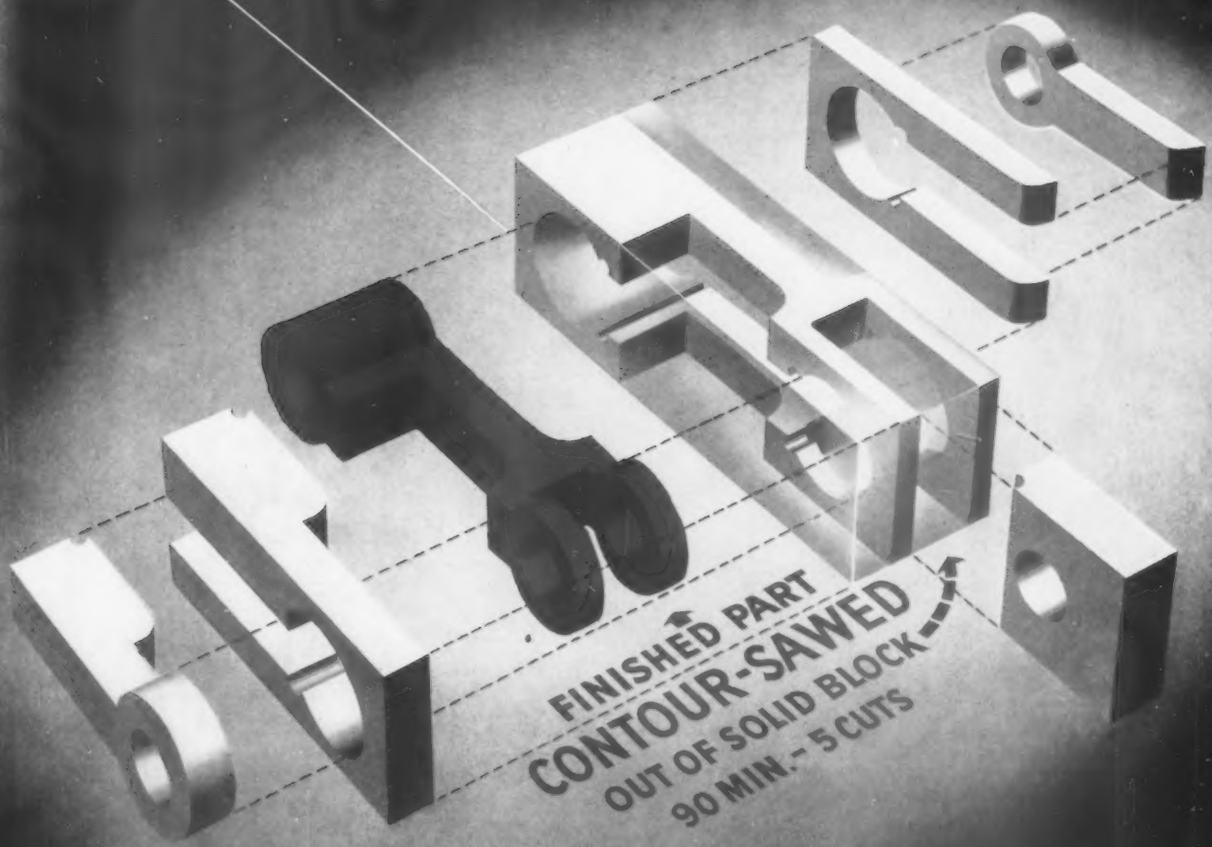
THE METHOD OF LOW-COST PRODUCTION



Possible only by Contour Sawing—*world's fastest metal-removing process.* No other machine process can do this.

Exclusive features of Contour Sawing: 1—It is modern industry's shortcut around complex, time-taking setups. 2—Cutting tool leaves only a 1/16" slot—does not reduce to worthless chips the metal that it removes. 3—Cutting is continuous by hundreds of sharp, hard tool points on a band—there is no backstroke or lost motion. 4—Only a short training period required—not years of experience.

Like this brake lever made by Wincharger Corporation of Sioux City, Iowa, countless jobs formerly requiring castings were slow, expensive. Now Contour Sawing cuts them from stock with ease, speed and economy—all materials, even carbon and tough alloy steels, a foot or more thick.

Write for booklet *"DoALL Equals Ten Plus"* which compares Contour Sawing with ten other machine methods. It is distributed free to requests under company letterheads.

The DoALL Company

DoALL STORES IN PRINCIPAL CITIES

MACHINE-TOOL DIVISION
MINNEAPOLIS 4, MINN.

NOW the *Improved* TECO Cemented Carbide

Gives you these features in MUCH GREATER MEASURE!

- MORE PIECES BETWEEN GRINDS
- MORE GRINDS PER TOOL
- LESS DOWN TIME
- LOWER TOOL COST

As every user knows, Teco Cemented Carbide has always delivered more production, at lower cost. Now, the *Improved* Teco outdoes itself in speeds, feeds, break-resistance and longer tool life . . . as proved by months of careful testing, on a wide variety of tough jobs.

Improved Teco Cemented Carbide is not a new material—but the already superior Teco made much better by new techniques in heat-treating, measuring, controls—plus supervision by our highly skilled carbide specialists now returned from war duty.

Whether you're a regular Teco user—or a "first-timer"—you can expect carbide performance beyond any you ever experienced. Make your own tests. Replace present carbide tools on any job, with the *Improved* Teco Cemented Carbide. Then check pieces produced—grinds per tool—tool life—tool cost.

Send details of your job set-up, or have one of our tool engineers discuss your needs. Ask for latest catalog and price list.

TUNGSTEN ELECTRIC CORPORATION
570 39th Street, Union City, New Jersey

Improved
TECO
CEMENTED CARBIDE

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In the Sperry Rail Welders, Oilgear grips rail ends, positions, aligns, and holds them with increasing pressure while establishing welding contact, releases welded rails, moves into position for next cycle.

Do you need tremendous power or little power . . . exquisitely applied? *Then call in Oilgear*

Did you know that standard railroad rails can be welded together in homogeneous units thousands of feet long? That they can be welded on the right-of-way, the increasing length stretching out behind on flat cars and easily negotiating 15 degree reverse curves in the track? That it's all done automatically, eliminating the human element? And that Oilgear Fluid Power furnishes not only the tremendous power to grip the massive load but the tremendous precision that matches perfectly the faces-to-be-welded with increasing pressure which climaxes in the final weld?

You may need power that can be applied with precise control . . . power that can be increased or decreased smoothly and instantly . . . infinitely variable speed . . . automatic work cycles . . . extremely accurate control of position or speed of a reciprocating member . . . constant horsepower output through all or a part of a speed range . . . or any of scores of other functions. Whatever your straightline or rotary power transmission problem you will find a better solution in Oilgear Fluid Power. Write now without obligation. THE OILGEAR COMPANY, 1308 W. Bruce St., Milwaukee 4, Wisconsin.

Oilgear Fluid Power

ARE YOU TRYING TO:

1. Apply large forces through long . . . or short . . . strokes at variable speeds? **2.** Obtain automatic work cycles, variable speeds in either direction . . . with or without preset time dwell? **3.** Apply large forces through continuous or intermittent reciprocating cycles at constant or variable velocities? **4.** Obtain extremely accurate control of either position or speed of a reciprocating member? **5.** Apply accurately variable pressure either static or in motion? **6.** Closely synchronize various motions, operations or functions? **7.** Apply light . . . or heavy . . . forces at extremely high velocities through either long or short distances of travel? **8.** Obtain continuous automatic reversing drives at constant R.P.M. or over a wide range of speed variation? **9.** Obtain accurate remote control of speed and direction of rotation, rates of acceleration and/or deceleration? **10.** Obtain constant horsepower output through all or part of a speed range? **11.** Obtain automatic torque control? **12.** Obtain accurately matched speed of various rotating elements? **13.** Obtain constant speed output from a variable speed input? **14.** Obtain full preset automatic control, elimination of problems of shock, vibration, etc.?

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Your Most Direct Source of Information ON

GEAR SHAVING

Red Ring Gear Shaving Machines correct gear cutting errors and improve gear tooth surfaces on spur and helical gears up to 220″ PD.—Also to develop Elliptoid tooth form on gears up to 36″ P.D.

GEAR LAPPING

Red Ring Gear Lapping Machines process spur, helical, shoulder and cluster gears removing heat treat distortion and giving fine finish.

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By testing a pair of gears on a Red Ring Sound Tester you determine before assembly the type of bearing and the noise factor when encountered.

GEAR CHECKING

The Red Ring Universal Gear Checker shows quickly and accurately errors in index, helix angle, tooth size, eccentricity, interference and wobble.

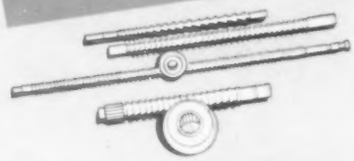
ROTO SHAVING

The Red Ring Roto Shaver finishes cylindrical, conical and flange surfaces faster and more effectively than can be done by green grinding.

ROTO MILLING

The Red Ring Rotomill Machines cylindrical work, conical work and flanged parts faster and more economically than can be done on a lathe.

BROACHES



Red Ring Naloy Broaches because of the methods of fabrication and treatment give you 50% more production per grind than conventional tools.

NATIONAL BROACH REPRESENTATIVES

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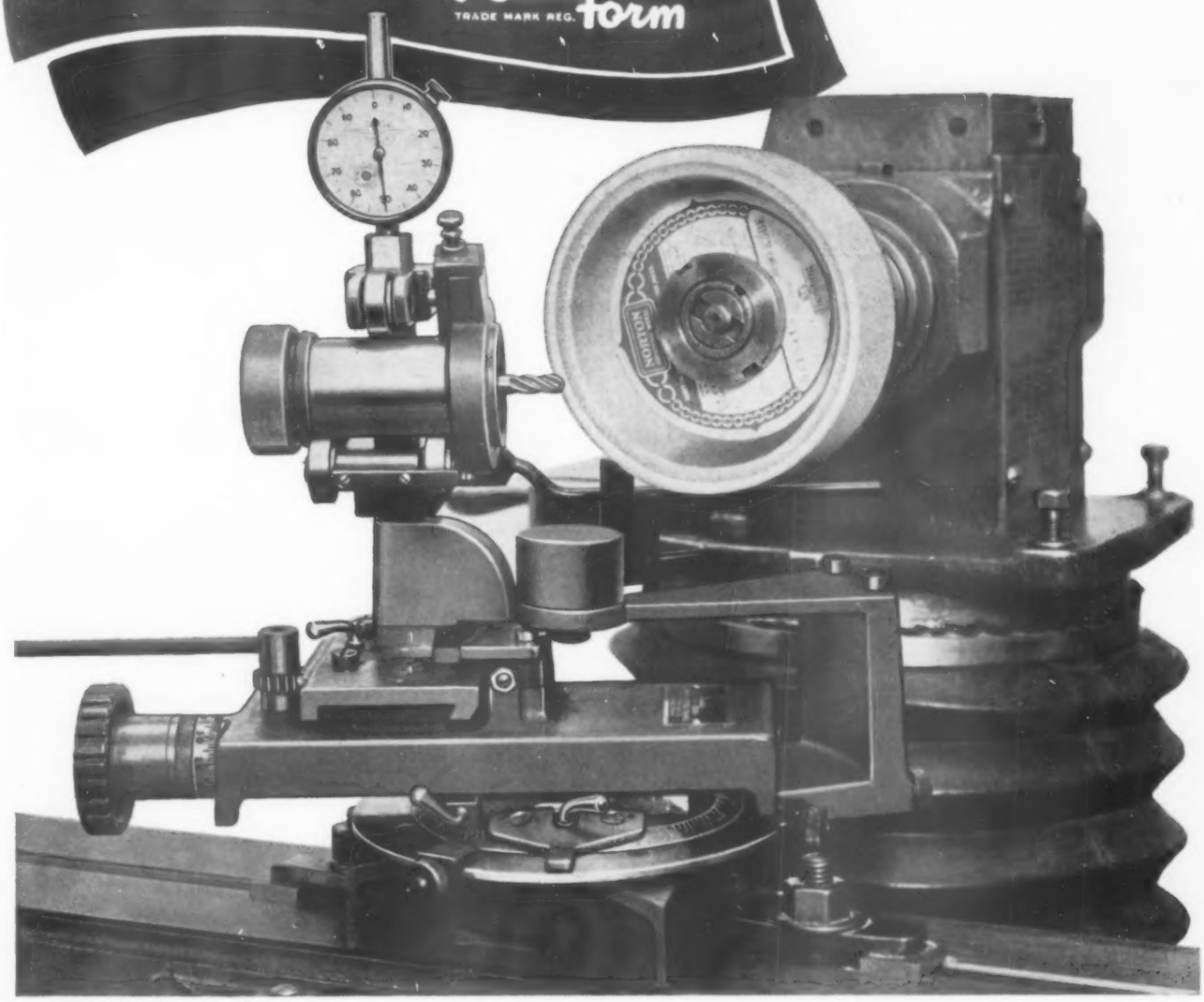
SPECIALISTS ON SPUR AND HELICAL INVOLUTE GEAR PRACTICE

ORIGINATORS OF ROTARY SHAVING AND ELLIPTOID TOOTH FORMS

HERE IT IS!

THE IMPROVED MEYERS Radiform

TRADE MARK REG.



PATENTS PENDING

● THE ONE MACHINE that generates the form direct on, End Mills, Tool Bits, Milling Cutters and similar tools in high speed and tungsten carbide without first forming the grinding wheel; also forms grinding wheels.

THE IMPROVED MEYERS RADIFORM NOW AVAILABLE

For further information and details wire or write

W. F. MEYERS COMPANY • *Established 1888*

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CARBOLOY (TRADEMARK) CEMENTED CARBIDE "STANDARDS"

Speed Production, Cut Costs

ON JOB LOT WORK TOO!

Here's how Oakland Machine Works*—an aggressive small shop doing diversified job-lot work, keeps tool costs low, makes fast changeovers, and meets close schedules:

1. They plan tooling to widely use low-cost, readily available "Standard" Carboloy Tools—adaptable to 60-80% of most jobs.
2. For "special" tooling—not adaptable from "standards"—they design and tip them with inexpensive "Standard" Carboloy *Blanks* from stock.

Whether your machining applications involve quantity production or job-lots, your plant, too can benefit by this low tool cost, wide adaptability, and ready availability made possible by Standard Carboloy Tools and Blanks. *Write for Catalog GT-175-R.*

1

1. EXTRA DIVIDENDS FROM "STANDARDS"

On **this** job-lot application—machining cast iron pulleys—"Standards" not only held down **initial** tool costs but also stepped up production; kept machines running 4 times longer per tool grind. For maximum savings, Standard Carboloy Tools were adapted to 8 roughing and finishing operations; while all "specials," except drill, were tipped with "Standard" Carboloy Blanks.

2

2. QUICK CHANGES AT MINIMUM COST

On job-lot work, set-ups change frequently! "Today" the job is a carbide-tipped 11-tool set-up for cast iron water pump housing parts. "Tomorrow" it may be an entirely different 27-tool set-up for one-piece aluminum fans and pulleys. By carefully planned use of adaptable "Standard" Carboloy Tools, Oakland keeps tool cost down despite frequent changes.

3. MACHINING CAST IRON HOUSINGS AT 340 F.P.M.

When carbide tools went on this job—machining cast iron water pump housings—speeds jumped to 340 F.P.M.; tool life stepped up 600%. For extra economy, the 7 tools used were made with "Standard" Carboloy Blanks, available from stock at low cost.

3

Oakland Machine Works regularly uses 3 of these Standard Carboloy Tool styles.

*Royal Oak, Michigan

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11124 E. 8 MILE AVENUE, DETROIT 32, MICHIGAN

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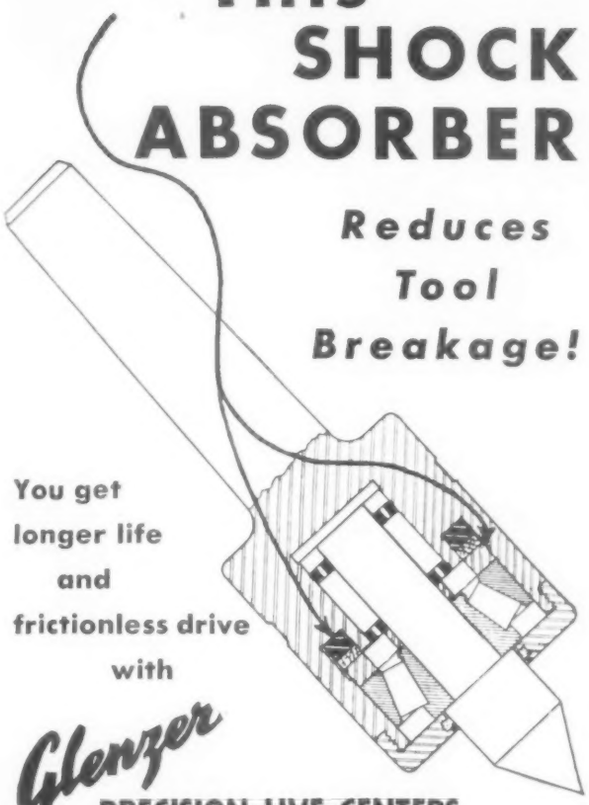
(TRADEMARK) CEMENTED CARBIDE

CHICAGO • CLEVELAND • DETROIT • HOUSTON • LOS ANGELES • MILWAUKEE • NEWARK • PHILADELPHIA • PITTSBURGH • THOMASTON

This SHOCK ABSORBER

Reduces Tool Breakage!



You get longer life and frictionless drive with

Glenzer **PRECISION LIVE CENTERS**

Work expands in cutting and machining due to heat. The three-layer resilient pad "Shock Absorber" to which the arrows point automatically compensates for this expansion. This relieves excess pressure on the Timken bearing, for it seats on this pad.

Reduces Spoiled Work

Let this Shock Absorber soak up the shocks which are bound to occur in all machining operations. Glenzer Live Centers quickly pay for themselves in longer tool life and fewer rejects —increase productive time.

●

Made for Morse Tapers #1 to #7 inclusive. Also in Slip-In, Slip-Over and Spindle Types. Body diameters $2\frac{1}{16}$" to 5". All Types have interchangeable parts in each corresponding size.

Utility Tools

THE J. C. ***GLENZER*** CO., Inc.
6467 EPWORTH BLVD. DETROIT 10, MICH.

WALKER-TURNER
MACHINE TOOLS
Cut Production Costs
...4 WAYS!

1. LOW FIRST COST: Sound design, volume production and manufacturing know-how keep W-T prices low.

2. LOW OPERATING COST: Compact, rugged construction, elimination of unessential weight, keep power and maintenance costs low.

3. WIDE SPEED RANGES: Selection of correct cutting speed for each material provides maximum cutting efficiency.

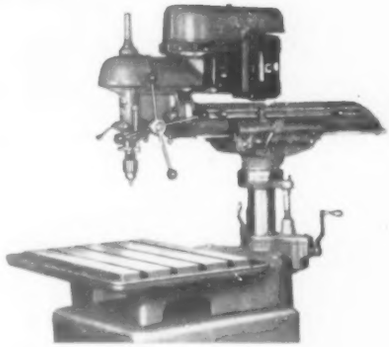
4. MULTI-PURPOSE DESIGN: Adaptable to a wide variety of operations — in standard or special set-ups in single or multiple installations—solving troublesome tooling problems at low cost.

W-T RADIAL CUT-OFF MACHINE

● Cuts all materials. Ram glides $21\frac{1}{2}$" on 8 ball bearings. Operates at all angles.

W-T RADIAL DRILL

● Speed range 110-8300 R.P.M. Head tilts 45° either way.



WALKER-TURNER COMPANY, Inc.
PLAINFIELD, N. J.

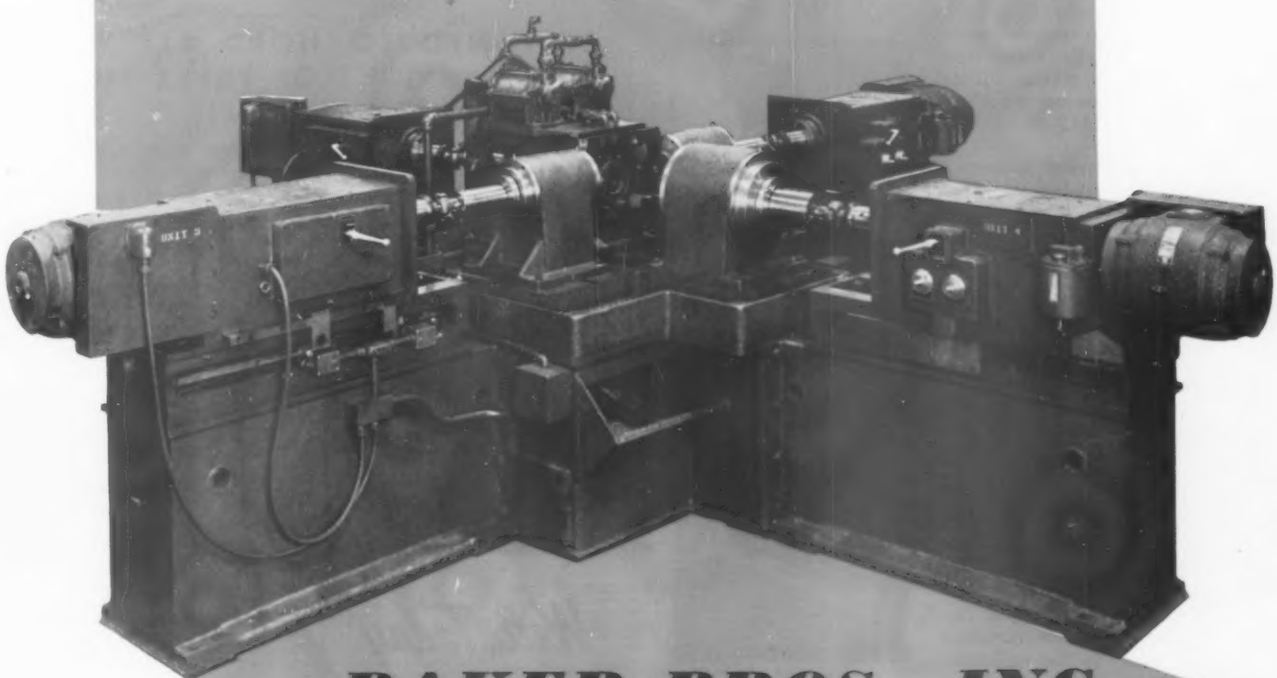
walker-Turner COMPANY, INC. PLAINFIELD, N.J.
MACHINE TOOLS
DRILL PRESSES • HAND AND POWER FEED • RADIAL DRILLS
METAL CUTTING BAND SAWS • POLISHING LATHES • FLEXIBLE SHAFT MACHINES
RADIAL CUT OFF MACHINES FOR METAL • MOTORS • BELT & DISC SURFACERS

New Baker hydraulic unit

Adapted to High Production Low Cost Work

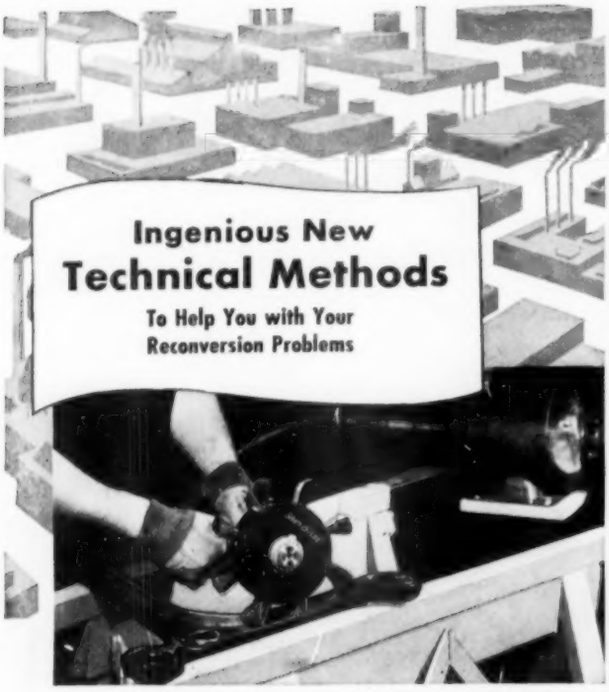
Introducing a self-contained hydraulic feed, saddle-type unit adapted to single and multiple spindle operations with capacity to take 3, 5, or 7½ HP. Has standard automatic cycle of rapid traverse forward feed and rapid traverse return, and can be furnished with positive stop and delayed reverse. Note these features:

1—A high production machine from standard units
2—Mounted solidly on massive, welded steel beds
3—Boring bars support cutters close up to start
4—Long service is assured by hardened steel ways
5—Has trouble-free, self-contained lubrication
6—Permits flexible retooling and broad plant use



BAKER BROS., INC.

Toledo 10, Ohio



New Brush-Backed, Strip-Fed Abrasive Wheel Deburrs, Sands Any Surface!

For sanding in and around the most irregular contours—for deburring parts too large to be tumbled—for removing rust, paint and imperfections from wood, plastics, rubber, earthenware and metals—the new Sand-O-Flex brush-backed abrasive wheel is MOST PRACTICAL.

Abrasive Cartridge Shown Open

The central magazine houses a strip abrasive cartridge, to be fed out as needed in front of the eight brushes which "cushion" the abrasive, and force it evenly over the most difficult surfaces. The Sand-O-Flex comes in 3 sizes, and is adaptable to any stationary or portable motor shaft, with speeds up to 1750 RPM. Abrasives are available in grits for every need.

To help speed production in dry, dusty work atmosphere, many mills and factories urge workers to chew gum to help relieve dry throat. *The reason:* Because dust causes throat irritation and dryness—but chewing Wrigley's Spearmint gum helps keep workers' mouths moist and fresh. *The result:* Reduced work interruptions and "time outs" to the drinking fountain. Even when workers' hands are busy, they can refresh as they work "on the job." And the chewing action helps keep workers alert and wide-awake.

You can get complete information from the Sand-O-Flex Corporation, 4373 Melrose Ave., Los Angeles 27, Cal.

AA-74

NOW AVAILABLE FOR IMMEDIATE DELIVERY

THE *New* CLEVELAND INDEX HEAD

Regrind YOUR TOOLS IN EXACT CONCENTRICITY ON ANY SURFACE GRINDER

DESIGNED TO HOLD ALL TOOLS WITH STRAIGHT OR TAPER SHANKS FROM 1/16" To and incl. 1 1/2" Diam.

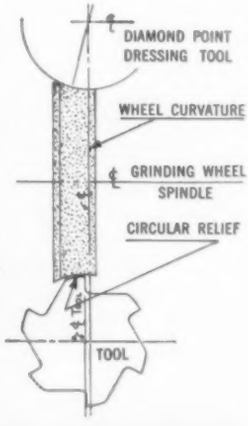
No longer need you discard your taps, reamers, end mills, etc., when they become worn or damaged.

360 degree graduations in three planes enable you to grind any desired angle or cutting edge on your tools with factory precision . . . in your own shop . . . on any surface grinder.

Write for catalog and complete information. See for yourself how you can reduce your tool maintenance costs with the Cleveland Index Head.

CIRCULAR RELIEF GRINDING . . .

A new method for regrinding tools. *Leaves No Land.* Ideal for spiral reamers, bent shank taps, end mills, etc. Complete data and information on request.



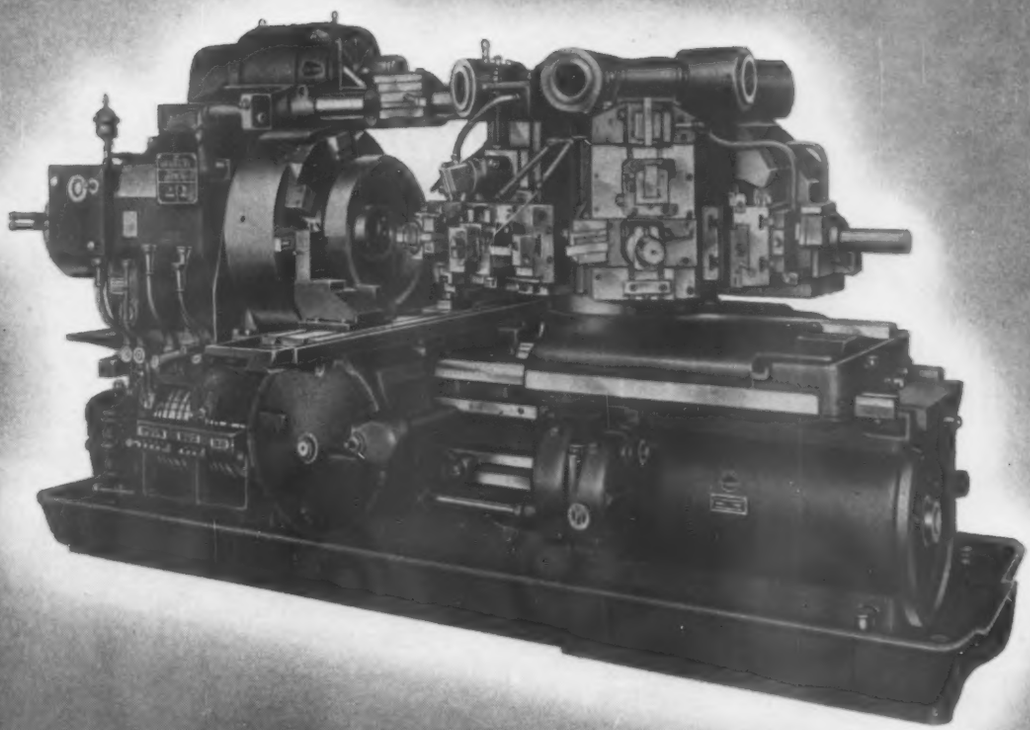
Write Today

1251 West 4th Street

GRINDERS & FIXTURES Inc.
Cleveland 13, Ohio

P&J 8 DT 8 DXT AUTOMATICS

for production of work requiring greater capacity and lower cost...



CONDENSED SPECIFICATIONS

	8 DT	8 DXT
Number of Turret Faces	6	6
Turret Travel	32"	32"
Turret Feed	16"	16"
Turret Slide Adjustment	8⅛"	18⅛"
Swing over bed	36"	36"
Swing over cross slide	23"	23"

These additions to the famous lines of P&J Automatic Chucking and Turning Machines provide that extra capacity required for the handling of large work requiring close tolerances and high output at reduced costs.

Both the 8-DT and the 8-DXT Automatics employ unit construction throughout. Base is of heavy box section, provided with hardened, and ground steel ways of liberal dimensions. A rugged, well-balanced turret slide construction assures accuracy and long service.

The specific features of these machines are described in detail in Bulletin 112, sent without obligation on request.

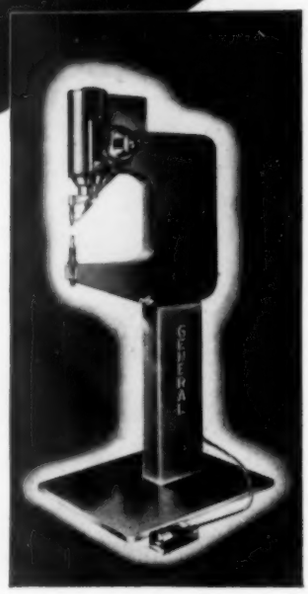
Authorized Agent, U. S. War Assets Corporation

POTTER & JOHNSTON MACHINE CO.

Pawtucket, R. I.

BUY EXTRA VICTORY BONDS AND HELP FINISH THE JOB SOONER

RIVETERS
Built for YOUR Job at "STOCK-LINE" prices



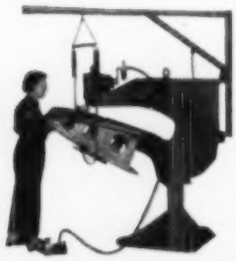
General Riveters will furnish a machine tailored to exactly fit your needs at a stock item price

THERE'S no need to pay a premium price for a special machine. If you have a riveting problem, we have the answer in a riveter especially designed for your job. Best of all, it will probably cost no more than a stock riveter.

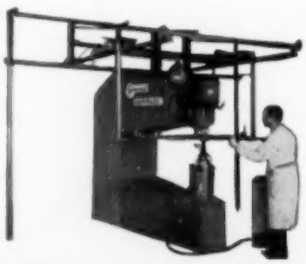
Under present conditions, many industries find it aids production, where the work permits, to use General Automatic feed riveters, equipped with indexing fixtures. They insure maximum output by setting the pace for the operators, and improve quality by reducing the human element.

Let us survey your riveting operations and recommend the best equipment for the job. There is no obligation. Simply send blue-prints or samples of parts to be riveted with a description of your present assembly procedure and production requirements. General Riveters Equipment is guaranteed, deliveries are prompt.

Pneumatic Squeezer for leading edges.



Combination Drill and Automatic Feed Hydraulic Squeezer.



GENERAL RIVETERS INC.
formerly GENERAL ENGINEERING CO.
781 HERTEL AVE. BUFFALO 7, N.Y.

Attend **THIS FREE SCHOOL**

Learn latest practices in use and maintenance of CARBIDE CUTTING TOOLS

When production is lagging and unit costs must be lowered . . . that's when *extra skill and knowledge* PAY OFF. Prepare yourself now by attending this one-week course in latest carbide practices. You learn by doing on modern production machines . . . no tedious book work! Carbide experts conduct all classes. Ample facilities. Classes are limited in size to assure individual instruction. Tuition is FREE.

Small classes with competent instruction assure easy learning. A well-balanced course of instruction.

CERTIFICATE TO ATTEST YOUR TRAINING

Upon completion of the course, each graduate is given a certificate attesting to his having satisfactorily completed the W-S Training Course in Carbide Cutting Tools. It "shows that you know."

Write or wire for further information and registration blank. Address: Director of Training, WENDT-SONIS COMPANY, Hannibal, Missouri.

WENDT SONIS
CARBIDE TIPPED CUTTING TOOLS
BORING TOOLS • CENTERS • COUNTERBORES • SPOTFACERS • CUT-OFF TOOLS • DRILLS • END MILLS • FLY CUTTERS • TOOL BITS • MILLING CUTTERS • REAMERS • ROLLER TURNING TOOLS • SPECIAL TOOLS

DELTA-MILWAUKEE QUALITY IN A LOW-COST TOOL FOR SENSITIVE SMALL-HOLE DRILLING

DELTA MILWAUKEE

REG. U. S. PAT. OFF.

Super-Hi*-Speed Drill Press

Single-spindle model

A high-speed drill press by Delta-Milwaukee, for greater accuracy on small-hole work from .025" to 1/4" diameter — in plastics, aluminum, and other metals. Drills to the center of a 14" circle.

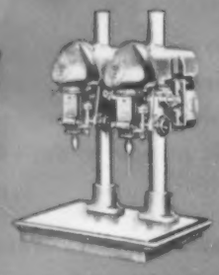
Embodies all the well-known construction features and operating advantages of other Delta-Milwaukee drill presses. Three-step pulley permits speed range of 12,000 . . . 8000 . . . 5000 R.P.M. Dynamically-balanced motor. Full spindle travel of 2 1/4". Specially-selected Jacobs chuck.

See your Delta industrial distributor for the complete story on the Delta-Milwaukee Super-Hi-Speed Drill Press.

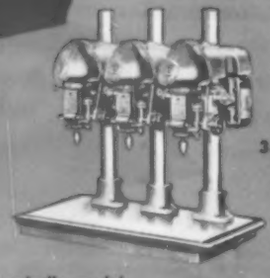
Send coupon for Bulletin No. A-14-3.

Subsidiary of Rockwell Manufacturing Co.

- Single-spindle model — with production table
- 2-spindle, 3-spindle, and 4-spindle models — with sectional tables
- Head, complete with motor, available separately for use on your present 14" drill press columns



2-spindle model



3-spindle model

4-spindle model

Tear out coupon and mail today!

THE DELTA MANUFACTURING CO.
611F E. Vienna Ave., Milwaukee 1, Wis.

Please send me Delta-Milwaukee Super-Hi-Speed Drill Press Bulletin No. A-14-3 and also bulletins on tools I have checked:

- ☐ Drill Presses
- ☐ Band Saws
- ☐ Abrasive Belt Finishing Machine
- ☐ Cut-Off Machines
- ☐ Toolmaker Grinders
- ☐ Tool Grinders

Name..... Position.....

Company.....

Address..... ( ) State.....

City.....

M-19

*Trade Mark Reg. U. S. Pat. Off.

Broaching SIMPLIFIES MANY PROBLEMS OF Production Management

Many production executives overlook one of the principal advantages of broaching—its simplicity as a machining operation.

A great deal of specialized experience and ability is required in the design and manufacture of efficient broaching tools and fixtures. Through all of the engineering and production steps, Detroit Broach accepts full responsibility and, when desired, follows through with complete tooling service on the customer's machines. With these important factors properly handled, broaching production in itself is extremely simple and trouble-free.

Broaching does not require skilled operators and, of most importance, no continuous supervision is necessary. Supervisory personnel can always devote the major part of its time to other phases of plant operation. The life of broaching tools is extremely long, requiring minimum maintenance. Once the job is running, there is little or no interruption.

To these advantages are always added those of faster production, greater accuracy, better finishes and lower costs. Together they represent a sure-fire opportunity for more profitable production . . . with practically all the responsibility for efficient machining operations placed in the competent hands of Detroit Broach engineers and production men.

This simplification of a number of your problems in production management is a subject that a Detroit Broach man will be glad to talk over in detail with you. Why not call him in today?

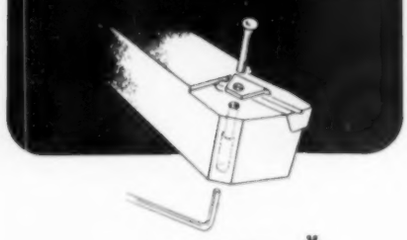
MEMBER BROACHING TOOL INSTITUTE

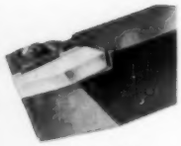
DETROIT Broach COMPANY

20201 SHERWOOD AVENUE • DETROIT 12, MICHIGAN

NOW—*New* *Clamped-on Tips*

KENNAMETAL TOOLS FOR LIGHTER MACHINING JOBS



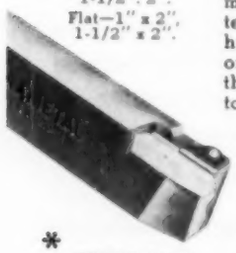


STYLE 11HD
Available in shank sizes:
Square—1-1/4", 1-1/2", 2".
Flat—1" x 2", 1-1/2" x 2".

* **STYLE 11CL**
Square—1".
Available in shank sizes: Flat—1"x1-1/4, 1"x1-1/2"

STYLE 1CL *
Available in shank sizes:
Square—1".
Flat—1" x 1-1/4", 1" x 1-1/2"

STYLE 12HD
Available in shank sizes:
Square—1-1/4" 1-1/2", 2".
Flat—1" x 2", 1-1/2" x 2".



* **STYLE 12CL**
Available in shank sizes:
Square—1".
Flat—1"x1-1/4" 1" x 1-1/2"

* **STYLE 2CL**
Available in shank sizes:
Square—1".
Flat—1"x1-1/4" 1"x 1-1/2"

TWO new styles of tools—straight and offset shanks—with clamped-on Kennametal tips, have been developed so that the outstanding operating and maintenance advantages that characterize our well-known HD line for heavy duty work, may also be realized on lighter machining jobs. Among the advantages provided by these new tools are:

More consistent performance and greater durability from thermally strain-free assembly;

Smooth, unimpeded chip flow assured by perfected clamping arrangement, correctly positioned;

Exceptionally strong Kennametal tip—diamond ground on bottom face—firmly supported by plane surface of heat-treated steel shank;

Dull tips can be advanced, resharpened time and again, and major part utilized—tip only is reground;

Fewer tools to stock—many tips can be used during life of one shank;

Tips of different grades can be clamped in same shank;

Tips can be supplied with permanent, molded-in chip breaker, constant in depth, but adjustable in width by varying amount ground from end, or side cutting edges.

Illustrations show the new styles, as well as the widely used HD style, of clamped-on-tip Kennametal tools. Captions indicate sizes available.

Send Today for Supplement 2 . . . of Catalog 45, for complete specifications and prices.

KENNAMETAL
SUPERIOR CEMENTED CARBIDES
KENNAMETAL Inc., LATROBE, PA.

POWER FEED For Facing

BORING, TURNING, FACING, UNDERCUTTING COMBINED IN ONE TOOL HEAD CHANDLER-DUPLEX

The power feed feature for facing operations insures smooth, uniform movement of tool across work surface. This power feed can be engaged or disengaged instantly. Adjustment of tool for boring is obtained in increments of 1/10,000 in direct reading.

Made in Four Sizes

Pat. No. 2,356,651

For Jig Borer, Drill Press, Milling Machine

● **ALL OPERATIONS IN ONE SET-UP**

Cutting bar can be set to any position in Tee slot of slide. Hardened and ground throughout. Feed screw and worm ground from solid. Gears and feed nut phosphor bronze. Head 3" dia. x 4" long. Wt. 9 lb. Any type shank furnished. Write for complete information.

CHANDLER TOOL CO.
514 OHIO AVE. MUNCIE, IND.

GAGES

IN **24** *HOURS*

(IN MANY SIZES)

Plug Gages, Ring Gages, Snap Gages (adjustable and solid). Flush-Pin Gages, Built-up Gages.

OUR GOOD GAGES

Prevent Spoilage
Speed-up Operations
Utilize Less Skilled Help
Reduce Costs

EASTERN PRECISION GAGE CO.
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We operate day-and-night.
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Send for illustrated folder D
HIGH-PRECISION PRODUCTION MACHINING AND GRINDING — NOTHING TOO DIFFICULT

THERE ARE 7 FACTORS

ON WHICH YOU SHOULD BUY

GAGES

1 ..DESIGN

Better design makes a gage easier and faster to use. VARD gages incorporate the best of the postwar gage design engineering.

2 ..MATERIAL

A well designed gage is a good buy when its basic material fully meets use requirements. VARD gages are made of Timken Graph-Mo steel, hard chrome plate or Norbide (Norton Co.'s boron carbide).

3 ..GRINDING

VARD gages are shaped on batteries of modern grinding machines — in temperature controlled rooms by expert gagemakers. They are ACCURATELY ground.

4 ..INSPECTION

Microscopic inspection equipment is necessary for gage testing. VARD owns visual and mechanical testing equipment of all types, some reading to .000001-inch accuracy.

5 ..PACKAGING

A gage properly made must still be safely delivered into your hands. VARD gages are wrapped in shock-resisting packing and then sealed in individual boxes. Small gages are sealed in plastic tubes.

6 ..AVAILABILITY

VARD stocks most sizes of standard thread and dimensional gage. Our dealers also can supply you. Special gages are now produced in record time.

7 ..SERVICE GUARANTY

VARD guarantees its products against all defects of materials or workmanship. Moreover, VARD can rebuild or renew your worn gages.

Write for the VARD Gage Catalog...Ask for data on gages you need.

VARD INC.
Gagemakers

2981 EAST COLORADO STREET — PASADENA 8, CALIF., U. S. A.

Our 3 POINT POLICY

Insures Lower Production Costs for YOU

QUALITY *Precision Built*

DIES · FIXTURES · JIGS · GAGES *are*

1. *Engineered for maximum production capacity*
2. *Built Right*
3. *Priced Right*

Our customers like this 3 Point Policy. It keeps production costs down—helps keep them "in line." ★ Every tool we design and build must measure up to this yardstick. If you need tools to get work out F-A-S-T and without interruption, drop us a line TODAY!

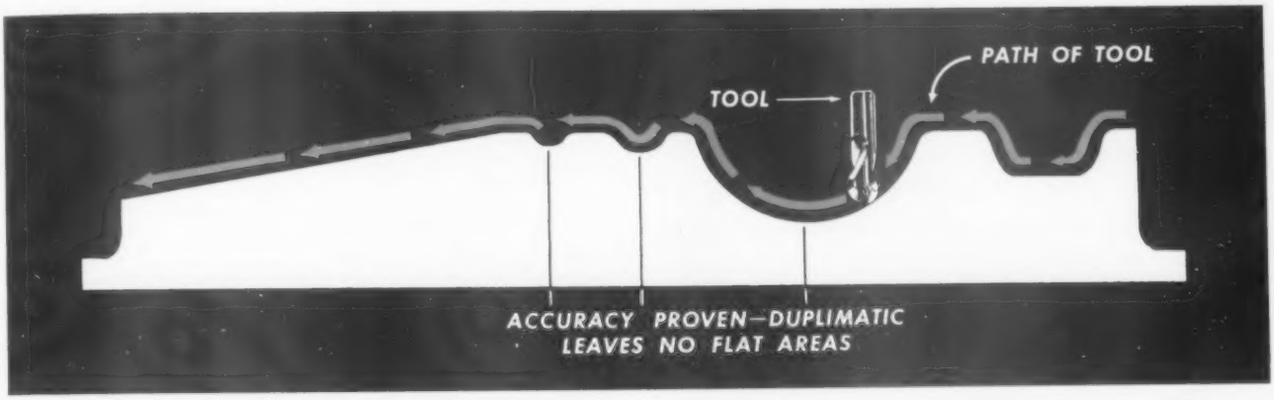
QUALITY TOOL & DIE CO.

Manufacturers of "Quality" Products

401-15 NORTH NOBLE STREET, INDIANAPOLIS 2, INDIANA

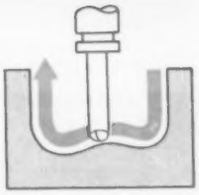
HERE'S *Just One* OF MANY REASONS WHY **DUPLIMATIC** IS THE ULTIMATE IN DUPLICATING MACHINES

Uniform Rate of Feed

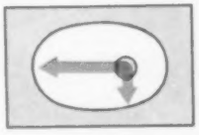


The irregular shapes of the above pattern are automatically machined at uniform speed and depth of cut by a DUPLIMATIC control attached to a standard milling machine. Rate of feed is as high as cutter and work piece will allow. Rate of feed is *uniform* regardless of the contour, due to DUPLIMATIC'S *inverse feed control*—an exclusive feature—requiring no manual adjustment. This feed control is essential for most efficient processing as the sharpest angle of climb need not be a consideration in the feed rate used and allows for feeding *into* as well as *out of* the work piece. DUPLIMATIC, the electro-hydraulic control, is interchangeable with most types of machine tools. It does not interfere in any way with standard operation of the machine tool.

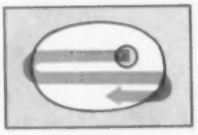
Die Sinking



WITH FEED IN ANY DIRECTION



WITH INDEXING



Contouring

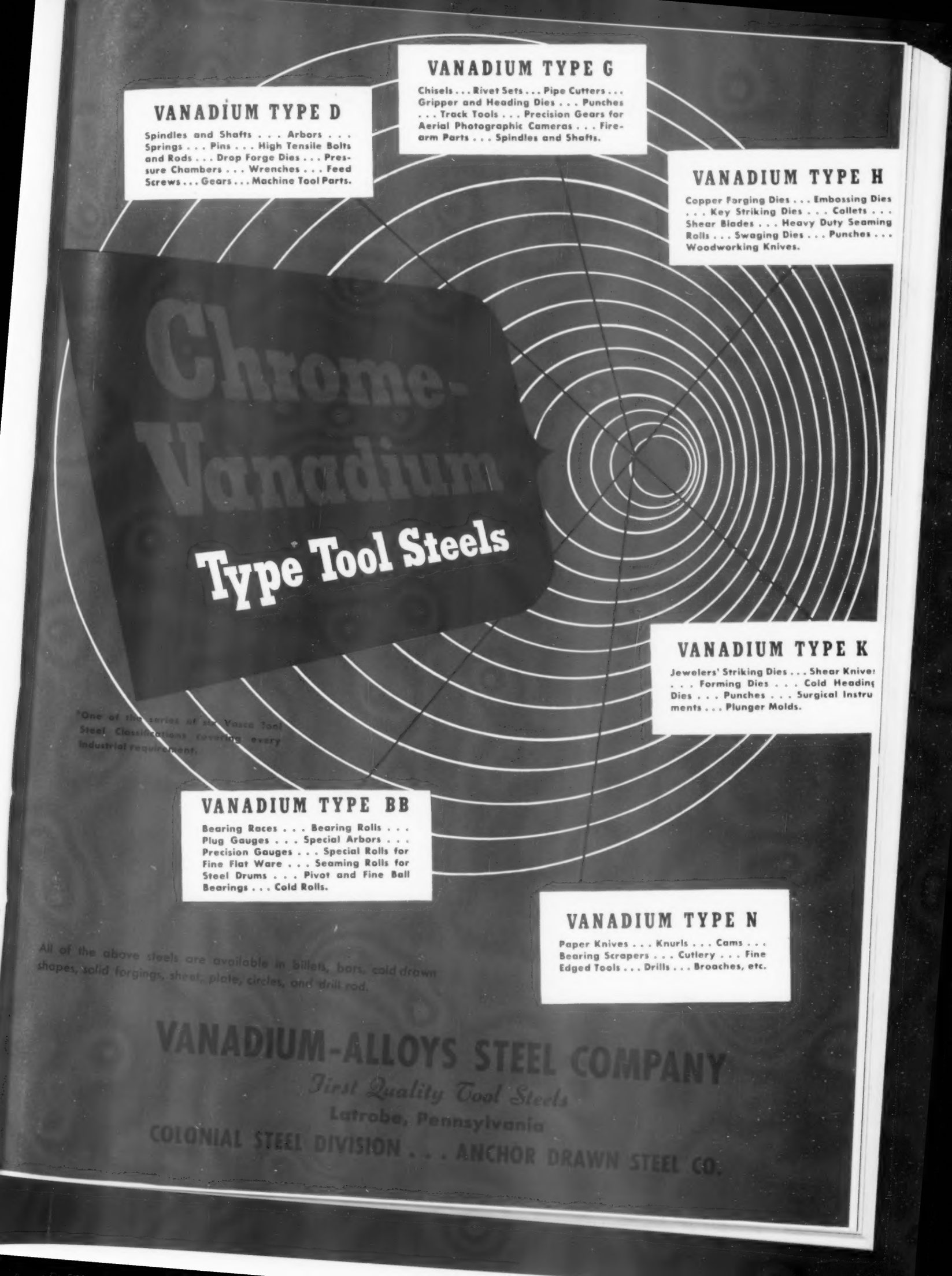
ALL these operations are possible with one DUPLIMATIC control attached to a standard milling machine.

DETROIT UNIVERSAL DUPLICATOR CO.

18100 RYAN ROAD DETROIT 12, MICHIGAN

Write Today!

Tell us what kind of work (production or tool room) you are doing. We'll tell you how DUPLIMATIC will speed your work, eliminate the need for special machine tools. No obligation. Send complete data.


VANADIUM TYPE G
Chisels . . . Rivet Sets . . . Pipe Cutters . . . Gripper and Heading Dies . . . Punches . . . Track Tools . . . Precision Gears for Aerial Photographic Cameras . . . Fire-arm Parts . . . Spindles and Shafts.
VANADIUM TYPE D
Spindles and Shafts . . . Arbors . . . Springs . . . Pins . . . High Tensile Bolts and Rods . . . Drop Forge Dies . . . Pressure Chambers . . . Wrenches . . . Feed Screws . . . Gears . . . Machine Tool Parts.
VANADIUM TYPE H
Copper Forging Dies . . . Embossing Dies . . . Key Striking Dies . . . Collets . . . Shear Blades . . . Heavy Duty Seaming Rolls . . . Swaging Dies . . . Punches . . . Woodworking Knives.
Chrome-Vanadium
Type Tool Steels
VANADIUM TYPE K
Jewelers' Striking Dies . . . Shear Knives . . . Forming Dies . . . Cold Heading Dies . . . Punches . . . Surgical Instruments . . . Plunger Molds.
"One of the series of six Vasco Tool Steel Classifications covering every industrial requirement.
VANADIUM TYPE BB
Bearing Races . . . Bearing Rolls . . . Plug Gauges . . . Special Arbors . . . Precision Gauges . . . Special Rolls for Fine Flat Ware . . . Seaming Rolls for Steel Drums . . . Pivot and Fine Ball Bearings . . . Cold Rolls.
VANADIUM TYPE N
Paper Knives . . . Knurls . . . Cams . . . Bearing Scrapers . . . Cutlery . . . Fine Edged Tools . . . Drills . . . Broaches, etc.
All of the above steels are available in billets, bars, cold drawn shapes, solid forgings, sheet, plate, circles, and drill rod.
VANADIUM-ALLOYS STEEL COMPANY
First Quality Tool Steels
Latrobe, Pennsylvania
COLONIAL STEEL DIVISION . . . ANCHOR DRAWN STEEL CO.

Smooth Sharp Edges

FOR CEMENTED CARBIDE TOOLS

Bay State provides top grinding performance for your cemented carbide tools because

1. Fractional Grades—
   3 grades within a grade, more accurately "fitting grade to grind."
2. Controlled Porosity—
   scientific control of wheel structure.
3. Consistent Duplication.

For grinding cemented carbide tools, you want sharpening wheels that are cool and fast-cutting, produce keen edges and have long life. Bay State's Green Grit Wheels meet these requirements fully.

KOOLPORE, Bay State's very open and porous Green Grit Wheel, is highly recommended by users for rapid grinding of the cemented carbides.

Make a trial of Bay State Green Grit regular structure and Koolpore types. For any grinding wheel need, remember Bay State's exclusive methods of duplicating original specifications. Write for recommendations for your needs or contact the Bay State distributor, warehouse, or field engineer in your area.

BAY STATE ABRASIVE PRODUCTS CO.
9 Union Street, Westboro, Mass.

BAY STATE

ABRASIVE PRODUCTS

Top Performance Consistently Duplicated

GRINDING WHEELS · HONING AND SUPERFINISHING STONES · PORTABLE SNAGGING WHEELS
MOUNTED WHEELS AND POINTS · CUT-OFF WHEELS · INSERTED-NUT DISCS · AND CYLINDERS

120,000 NUTS THREADED in 48 hours

BESLY TAPS meet peak demands of the Automatic Screw Machine Products Co.

The Automatic Screw Machine Products Co. produces nuts for those manufacturers who require better than average precision. Besly bent shank carbon steel taps were used in making this excellent production record. Besly also makes and can supply high speed steel bent shank taps.

HELPFUL FACTS FOR TAP USERS

Now in its second edition—this valuable tap manual offers up-to-date data on taps, and tapping procedures. Tables list many classes of fits. Tap drill sizes and tapped hole sizes are itemized in detail. *Write today on your own letterhead for your copy—free.*

In threading small hexagon steel nuts on automatic tapping machines, Besly Bent Shank carbon steel Tapper Taps produce up to 20,000 nuts per 8 hour day. 120,000 nuts in 48 hour work week. These nuts are ¼-inch milled from bar stock. In obtaining this high output, production costs are reduced to an absolute minimum. Tolerances are held consistently within narrow limits.

Whatever your tap requirements may be, Besly engineers can be of practical help to you in selecting the most suitable taps. Write, wire or phone today!

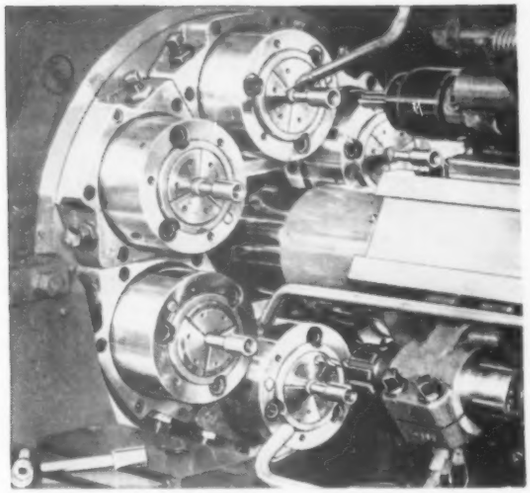
BESLY

BESLY TAPS • BESLY TITAN ABRASIVE WHEELS
BESLY GRINDERS AND ACCESSORIES

CHAS. H. BESLY AND COMPANY, 118-124 N. Clinton St., Chicago 6, Ill., Factory: Beloit, Wis.

Index of Tool Engineer Advertisers

June, 1946

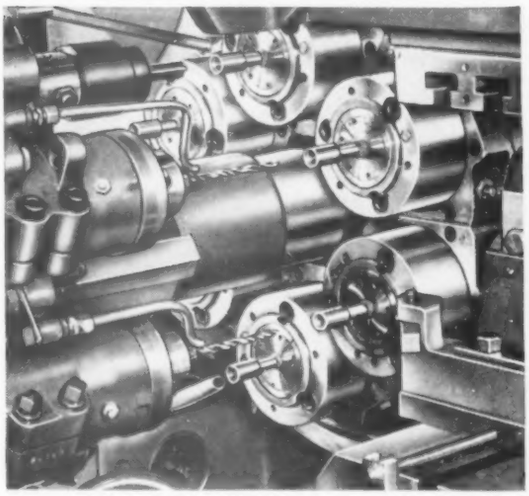


FRONT VIEW — New Britains are built to allow easy accessibility for simplified chucking, cutting tool and attachment setup.

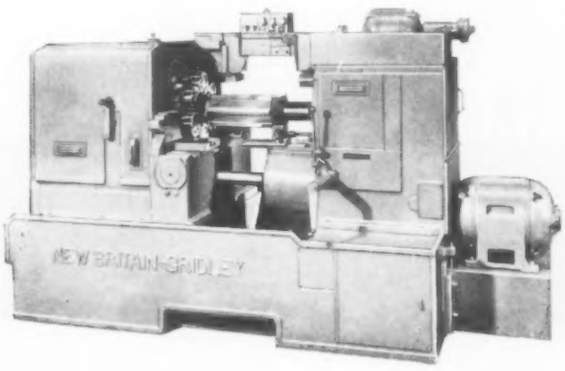
This will interest you if your work involves small accurate parts. In tooling and equipping our Model 65 Six Spindle Automatic Chucking Machines for the requirements of the Moeller Instrument Company, Richmond Hill, New York, provision was made for handling a variety of sizes of similar parts in various metals including steel, nickel copper alloy, and naval brass forgings.

The piece illustrated is a 3⅜" long tapered steel part, ¾" diameter on the large end, calling for drilling to a depth of 3½". It is held by specially designed collets, each with an extra long bearing, for drilling a deep hole leaving a thin wall. Six operations are performed at a gross production rate of 187 pieces per hour. Not a dramatically difficult assignment but a good illustration of the adaptability of New Britains to a wide range of applications . . . and another instance of high production at low cost per piece.

Many do not realize the wide range of practical applications for multiple spindle automatic screw and chucking machines. Our sales engineers *do*, and offer you a competent engineering service you may profit by investigating.



REAR VIEW — New Britain construction provides extra large chip space . . . lots of room from all sides giving excellent visibility and easy tool adjustment.



M-01038

MIRROR FINISH... TIME CUT IN HALF... ...$6.00 SAVED

by a 20"
LeBLOND HEAVY DUTY ENGINE LATHE!

OPERATION: Cutting taper, relief, and thread ... smooth finish overall ... on chrome moly (#4130) steel laundry extractor spindles in the plant of WESTERN LAUNDRY MACHINERY CO., North Kansas City, Mo.

With fast powerful drive and smooth vibrationless operation, this LeBlond lathe has cut machining time from 5 hours to 2½ hours, saves Western $6.00 per spindle, and Works Manager C. F. Miles states, "Mirror finish is the best we can do on that LeBlond!"

Formerly, Western Laundry Machinery Co. had to grind each spindle after turning on another lathe. Now, grinding is completely unnecessary and the LeBlond speeds out spindles with only the barest suggestion of a tool mark.

If that kind of turning performance sounds good to you, call in your LeBlond Agent. He'll show you the proper LeBlond lathe for your range of products and he may have the answer to that tough job of yours that, up to now, just hasn't gone fast enough or good enough. Better find out!

THE R. K. LeBLOND MACHINE TOOL CO., CINCINNATI 8, OHIO

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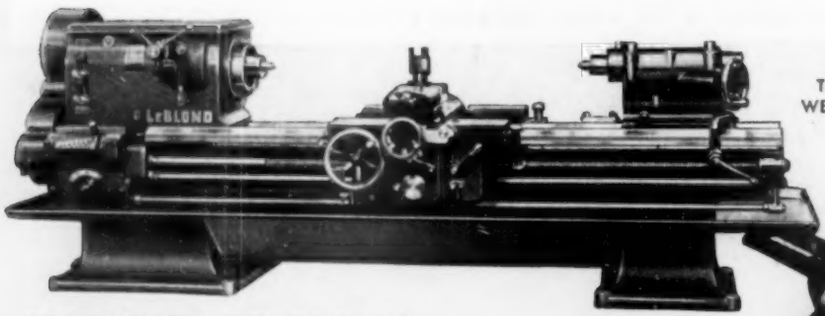
CHICAGO 6, 20 North Wacker Drive, STA 5561



20" LeBLOND HEAVY DUTY ENGINE LATHE

Turning an extractor spindle at WESTERN LAUNDRY MACHINERY CO.